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Sir, J. McGrigor Bart.

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AN

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PRINCIPLES

OF

Anatomy and Phyſiology.

VOL. II.

AN

EXPOSITION

OF THE

PRINCIPLES

OF

Anatomy and Phyſiology,

FOUNDED ON THE

DISCOVERIES AND IMPROVEMENTS

OF THE

LATEST AND MOST APPROVED WRITERS,

AND CONTAINING THE

PRAELECTIONES ANATOMICAE

OF

FERDINAND LEBER,

TRANSLATED FROM THE ORIGINAL, PUBLISHED IN
LATIN, AT VIENNA.

By WALTER VAUGHAN, M. D.

PHYSICIAN, AT ROCHESTER, IN KENT.

> The gen'ral ORDER, ſince the whole began,
> Is kept in NATURE, and is kept in MAN. POPE.

IN TWO VOLUMES.

VOL. II.

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NEUROLOGY.

Of the Nerves in general.

THE Nerves, which are the organs of ſenſe and motion, are ſoft bundles, compoſed of many white (324), medullary filaments,

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(324) That the nerves are the organs of ſenſe, but not of motion, has already been obſerved in the Myology (Note 153.).

The firſt and ſecond pair of nerves, more particularly, are not uniformly compoſed of white filaments; but have a brown ſubſtance in them, or a *cineritious ſubſtance*, as it is more commonly called. Dr. Battie ſuppoſed that all the nerves have a mixture of the ſame kind (*Exercit. de Princ. Anim.* IX. p. 126.). Monro ſays the nerves are of a browner colour than the medullary ſubſtance of the brain, and that their *pia mater* furniſhes them with a cineritious matter. But he excepts the optic nerves, and the *portio mollis* of the ſeventh pair (Obſ. on the Structure and Functions of the Nerv. Syſt.).

As to the nerves, as they appear to the naked eye, they ſeem, ſays Fontana, like ſpiral bands, or a ribband twiſted about a cylinder; and viewed through a lens magnifying only ſix times, theſe bands are ſeen uniformly the ſame and very diſtinct. But if they be ſeen through a miments, parallel one to another, and covered with *pia mater* (325).

All the Nerves ariſe either from the brain or the ſpinal marrow; the former are called *Cerebral Nerves*; and the latter *Spinal.* All the other nerves of the body ariſe from theſe.

The *Cerebral Nerves* ariſe either from the brain only, or from other parts, compoſed of the *medulla* of the brain and *cerebellum.* They go out of the ſkull through proper *foramina*, on each ſide, and are diſtributed in determinate places. There are nine pair of nerves belonging to the brain, viz.

1. The *Olfactory.*
2. The *Optic.*
3. The *Oculorum motorii.*
4. The *Trochleatores*, or *Pathetici.*
5. The *Trigemini*, or *Diviſi.*

---

a microſcope of much greater magnifying power, inſtead of ſpiral bands, we ſee parallel and twiſted fibres, which latter he thinks the true ſtructure (*Traité ſur le Venin de la Vipere, &c.*).

(325) Are not the trunks, and *funiculi* of the trunks of nerves, covered both with *dura mater* and *pia mater*? Zinn and Haller have told us that the *dura mater* does not accompany the nerves, in their courſe; but that their covering is a denſe, cellular membrane. Dr. Monro, however, ſuſpects this aſſeveration of Zinn and Haller; he avers that the outer covering of the nerves agrees with the *dura mater*, in tenacity, colour, and texture; he ſuſpects its properties to be the ſame as thoſe of the *dura mater.* Of the *funiculi*, where they can be examined, he ſays they have a ſimilar tenacious denſe, fibrous coat, and a thin vaſcular *pia mater* under it (Obſ. on the Struct. and Funct. of the Nerv. Syſt.).

6. The *Abducentes.*
7. The *Auditory*, or *Acouſtic.*
8. The *Vagi.*
9. The *Lingual.*

The *Spinal Nerves* are continued from the ſpinal marrow, paſs out through the *foramina* of the ſpine, and are diſtributed from thence over the whole body. There are thirty pair of theſe, which we divide into four claſſes, viz.

1.	Eight	pair of	*Cervical*	Nerves.
2.	Twelve		*Dorſal*	
3.	Five		*Lumbar*	
4.	Five		*Sacral*	

All the nerves of the brain and ſpinal marrow now enumerated, are covered, at their beginning, by *pia mater*, but at their egreſs from the ſkull, or ſpine, they are covered with *dura mater*, or ſome other firm, cellular texture, till they are come to their deſtined place, when they are deprived of this covering, and left in a ſoft and pulpy ſtate.

All the other nerves of the body come from theſe.

The *Ganglions* of Nerves are red bodies, oblong, but of various ſize and figure. They are ſomewhat harder than the nerves, and are encloſed in a proper coat. They conſiſt of medullary ſubſtance, and very many fibres of nerves interwoven together, and cohering in the form of a very delicate texture, within which many nervous fibres unite.

The uſe of theſe Ganglions is unknown (326).

When nerves are woven together, like a net, but do not change their colour, or loſe their covering, *Plexus* are formed; and ſuch *plexus* are named according to their figure, or the ſituation, or *viſcus* for which they are deſtined. There ariſe from both numerous nervous ramifications, which are diſtributed in various parts.

The Uſe of the Nerves is

1. To conſtitute the organs of the five ſenſes.

2. To preſerve the irritability, ſenſibility and motion of the body (327).

The

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(326) Some have ſaid, that the ganglions are produced by preſſure; but this is plainly contradicted by experience. For they are always found in the ſame places. The intercoſtal nerve forms very many large ganglions; three in the neck, and in the *thorax*, *abdomen*, and *pelvis* as many as it receives branches from the ſpinal marrow. But the cerebral nerves, the olfactory, optic, the fourth pair, the ſeventh, eighth, and ninth have no ganglions; the third, fifth and ſixth pair form ganglions. Ganglions are always found where either many nerves come from different parts into one, or where from one nerve many go off to different parts.

Perhaps their uſe is to keep up a ſympathy between the nerves, and to anſwer ſome particular, but unknown, end, in parts not ſubject to the will; for it has been often remarked that the nerves going to the vital parts come from *ganglia*.

(327) Nerves are not irritable; they are not elaſtic. Irritability is probably the excluſive property of muſcles (Note 153.).

Bodies

The Cerebral Nerves.

The *Nerves of the firſt pair*, or the *Olfactory Nerves*, ariſe from the medullary ſubſtance of

Bodies applied to certain parts of our ſyſtem, produce changes in thoſe parts, and theſe changes, which are definitive, are conveyed in ſome manner to the brain; in conſequence of which *Senſation* is produced.

The means by which the changes effected are conveyed to the brain, are the Nerves. The nerves have the excluſive property of *Senſibility*. Even in parts, where we can diſcover no nerves, we nevertheleſs believe them to be preſent, if the parts themſelves be ſentient.

If there were no communication between the brain and the organ of ſmelling, the mind, or ſentient principle, could not act; we could not ſmell. And, if the communication between the brain and the eye were deſtroyed, we could not ſee.

Senſation is a ſimple, original operation of the mind, which every man knows, but no man ever attempted to define. *To hear*, for example, or *To ſee*, is an operation of the mind. If *To ſee* were a mere operation of the *retina*, or eye itſelf, men would ſee when labouring of *amauroſis*, in which the fabric of the eye is entire. If *To ſee* were an act of the eye itſelf, we ſhould ſee all things inverted, as their images are inverted on the *retina*. Hence, it is plain, that not the identical impreſſion which is given to a nerve is conveyed to the mind, but only the effect of that impreſſion.

Seeing cannot exiſt of itſelf, neither can ſmelling; the preſence of every ſenſation ſuppoſes the exiſtence of ſomething; of which ſomething, or mind, ſenſation or feeling is an operation.

The parts immediately impreſſed by ſenſible bodies are called by ſome *Sentient Parts*; and the nerves, which render the parts ſentient, are called the *Sentient Extremities of the Nerves*.

All

of the anterior lobes of the brain, near the beginning of the medullary *crura:* they enter the

All our knowledge of things depends upon the impreſſion which they make upon our ſenſes; a man that has never ſeen, can have no idea of Seeing.

We enumerate only five ſenſes, viz. Smelling, Seeing, Hearing, Taſting, and Touching. Smelling is when in conſequence of certain particles ſuſpended in the air, and drawn into the noſtrils, an impreſſion is made on the ſentient extremities of the firſt pair of nerves; the effect of which impreſſion conveyed to the brain, or *Senſorium commune*, cauſes the mind to ſmell. Without doubt, the organ of ſmell is placed in the noſtrils to be affected by *effluvia* in the atmoſphere. Seeing is, when the rays of light falling on the *retina* make an impreſſion on it, the effect of which impreſſion conveyed to the brain, cauſes the mind to ſee, &c.

The nerves that are appropriated to particular ſenſations, are uniform and conſtant. All the nerves are uniform and conſtant in their courſe, connection, and diſtribution. It is extremely difficult to trace the nerves. The number of nerves beſtowed on the external parts is greater than upon the internal. The nerves that enter muſcles are firm and ſolid as far as they can be traced. The lungs, according to Wriſberg, are ſupplied with more nerves than the ſpleen, the *uterus*, or any other *viſcus* (*Annot. in* § 364. *Pr. Lin. Halleri.*).

Mr. John Hunter is of opinion that "the organs of the ſenſes have particular nerves, whoſe mode of action is different from that of nerves producing common ſenſation, and alſo different from one another, and that the nerves on which the peculiar functions of each of the organs of ſenſe depend, are not ſupplied from different parts of the brain."—Again, he ſays that "although the organs of ſenſe may likewiſe have nerves from different parts of the brain, yet it is moſt probable ſuch nerves are only for the common ſenſations of the part, and other purpoſes anſwered by nerves." Thus the organs of ſmelling, ſeeing, taſting, receive other nerves beſides the peculiar ones of thoſe ſenſes. Thus the fifth pair of nerves the noſtrils through the *foramina* of the ethmoid bone, are diſtributed in numerous ramifications

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nerves go to the noſe and eye in common with other parts. "Upon the ſame principle (continues Mr. Hunter), it is more than probable, that every nerve ſo affected as to communicate ſenſation, in whatever part of the nerve the impreſſion is made, always gives the ſame ſenſation as if affected at the common ſeat of the ſenſation of that particular nerve (Obſ. on the An. Oecon. p. 215.)."

That voluntary motion is performed, when we are conſcious of willing the motion of certain parts, is certain; but we are never conſcious of the particular muſcles employed. The will however can excite the motion of muſcles by means of the nerves; and if the nerve entering a muſcle, after the muſcle is taken from the reſt of the body, be irritated, the muſcle contracts. But of muſcular motion I have already ſaid enough (Note 153.).

The ſenſibility of nerves is different in different perſons, and different even in the ſame perſon at different periods of life. Some have endeavoured to account for the variation; but experiments are yet wanting to afford any plauſible explanation.

Various hypotheſes have been invented to account for the motions of the nerves. They who believed the nerves to be hollow tubes,—for Lewenhoeck affirmed that he often ſaw the cavity of nerves *(Epiſt. Phyſ. 32.)*; and Felix Fontana has lately told us that the fluid contained within the nerves is a tranſparent jelly ſoluble in water *(Tr. ſur le Venin de la Vipere*, &c.) I ſay, they who believed the nerves to be hollow cylinders, have attributed the *phoenomena* of the nervous ſyſtem to the *undulatory* motion of this fluid. But the ſuppoſition is ſo ridiculous, that I will not ſtop to confute it. Doctor Cullen's opinion is, that the motions of the nervous ſyſtem are oſcillatory motions of a ſubtile elaſtic fluid ſomehow connected with the medullary ſubſtance of the nerves: he ſuppoſes that the moſt part of impreſſions fications through the pituitary membrane, and conſtitute the organ of ſmell (328).

The

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made upon the organs of ſenſe, are made by the impulſes of the oſcillatory motions of other elaſtic fluids, and ſuppoſes that the impulſes received are greater or leſs as the ſentient extremities of the nerves are more or leſs tenſe (Mat. Med. Vol. I. p. 92.). I think Dr. Cullen's opinion the moſt plauſible, though it is certainly encumbered with inſurmountable difficulties, which cannot be ſtated in this place. Some again have aſſigned the *phœnomena* of nerves to *Tremor*. But what tremor can there be of inelaſtic, pulpy cords? And, if the cords were elaſtic and tremulous, they muſt communicate their tremor to the cords that are contiguous; ſo that from confuſed tremors, confuſed ſenſations muſt neceſſarily ariſe. Can it be, that the *Electric Matter* pervades the moiſt nerves? I cannot tell. The electric eel can kill other fiſh; and its power is voluntary, though it lives in water.

(328) The diſtribution of the firſt pair of nerves has, hitherto been conſidered as difficult to be known. Winſlow aſſerted, indeed, that they run forwards like ropes *(Exp. Anat. Sect.* VI. § 10.): but Zinn and Haller have rather conſidered them as never forming chords, but as continuing pulpy to their end, like the optic nerve, or as the *portio mollis* of the ſeventh pair is ſuppoſed to be. Mr. Hunter ſays,—" The firſt pair, while within the ſkull, differs, in ſome reſpects, from all other nerves; 1. It ſeems to be made up of a cortical and medullary ſubſtance, while the others appear to conſiſt of a medullary alone; and 2. It is different in that it does not ſeem to be compoſed of *faſciculi*, and has but one covering from the *pia mater* inveſting the whole nerve; whereas other nerves appear to have a covering round each *faſciculus*; and this is probably the reaſon that the firſt pair is weaker whilſt within the ſkull than the others. Its form is ſomewhat triangular, having three edges, from its lying in a groove, made by two convolutions of the brain. Its courſe is forwards, a little upwards and inwards, and where it lies upon the cribriform plate of the ethmoid bone, becomes

ſomewhat

The *Nerves of the ſecond pair*, or the *Optic Nerves*, ariſe partly from the *thalami nervorum opticorum*, as they are called, and partly from the *crura* of the brain, which they paſs over. They are united firmly afterwards; and each paſſes away from its own ſide to the oppoſite, where it enters the orbit poſteriorly and laterally, through a *foramen* of the *os ſphoenoides*, depoſits its coat, and is expanded into the *Retina*, which extends forward as far as the

ſomewhat larger, and divides into a great many branches, like ſo many roots, anſwering to the number of holes in that plate, except one for a branch of the fifth pair; but theſe diviſions we cannot ſee, they being covered by the body of the nerve, which cannot be raiſed without breaking off the ſmall branches at their origins. As the branches of the nerve paſs through this bone, they ſeem to take proceſſes from the *dura mater* with them; they then become firm chords, ſimilar to other nerves. Theſe branches, after they have got through the bone, form themſelves into two planes or diviſions, one paſſing on the *ſeptum*, the other on the turbinated bones. They of the *ſeptum narium*, in their paſſage to the noſe, are firſt continued a little way down in bony canals of the perpendicular *lamella* of the ethmoid bone; which holes become ſmall grooves in that bone; and thoſe on the oppoſite ſide, being more numerous and ſmaller, paſs down in ſmall holes that are on the inſide plate of the ethmoid bone, which holes are likewiſe continued into grooves, for a little way, upon that plate (Obſ. on An. Oecon p. 217.).”——Thus the nerves ſubdivide when they come to the membrane of the noſe, the ſubdiviſions being flat and ſmall, and, as we imagine, terminate on the external ſurface. Dr. Monro has traced them a great way in the noſe, in the human ſubject. He ſays, theſe nerves are hollow in ſheep and oxen (Obſ. on the Struct. and Funct. of the Nerv. Syſt.).

ciliary ligament, and conſtitutes the organ of ſight (329).

The *Nerves of the third pair*, or the *Motorii Oculorum*, ariſe from the lowermoſt *crura* of the brain, near the *Pons Varolii:* then paſs outwards and forwards towards the top of the petroſe proceſs, where they perforate the *dura mater*, enter the ſuperior orbital fiſſure, and are inſerted principally into the muſcles of the bulb of the eye, within the orbit. Hence their name. The ſuperior branch goes to the *rectus ſuperior* muſcle, and to the *elevator palpebrae ſuperioris*; another branch goes to the *rectus internus*; a third, an inferior, and a leſs branch, goes to the *rectus inferior*; and, laſtly, the fourth, and inferior, and greater branch, goes to the *obliquus inferior.*

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(329) According to Dr. Monro, the *retina* ends abruptly, ſomewhat farther back than the ciliary circle; and covers only that part of the bottom of the eye, on which the pictures of objects can be diſtinctly painted (Obſ. on the Struct. and Funct. of the Nerv. Syſt.). The decuſſation of the optic nerves in fiſhes has been obſerved by almoſt every anatomiſt.

Soemmering, Profeſſor at Caſſel, ſaw the decuſſation of the optic nerves in a ſquirrel that had a cataract in its left eye, he opened the *cranium* carefully, and found the nerve of the affected eye more flat, and oval, ſmaller, and of a more cineritious colour than the nerve of the healthy eye; and he traced the diſeaſed nerve, from theſe circumſtances of colour and ſhape acroſs the union to the right ſide. He again ſaw a ſimilar diſeaſe, and traced the deceaſed nerve acroſs the healthy one in horſes, and in a monſtrous pig with two heads (Lond. Med. Journ. Vol. 5. p. 289.). Whether do all the nerves croſs one another in the brain and ſpinal marrow?

There ariſes a branch from the third or fourth, which communicates with the firſt branch of the fifth pair, and forms the *Lenticular* or *Opthalmic Ganglion*, from which ſmall ramifications come out, run to the ciliary ligament, and vaniſh in the *iris*.

The *Nerves of the fourth pair*, or the *Trochleatores*, ariſe by a ſingle or a double beginning at Vieuſſens' valve, from the *crura* of the *cerebellum* laterally, thence they go forwards, pierce the *dura mater* immediately behind the third pair, and paſs, together with it, through the ſuperior orbital fiſſure. They are inſerted into the *trochlearis* muſcle of the bulb of the eye. Indeed, ſome branches go to other muſcles of the eye; and ſome are joined with the orbital nerves.

The *Nerves of the fifth pair*, or the *Trigemini* ariſe from the anterior part of the *crura* of the *cerebellum*. They are thick anteriorly at the apex of the petroſe proceſs, and paſs through the cavernous ſinus of the *dura mater*, ſituated at the ſide of the *ſella turcica*, where they are expanded into a ſemilunar ganglion, which was firſt taken notice of by the celebrated Profeſſor Gaſſer? From this ganglion there ariſe three branches, of which the firſt is called the *ophthalmic*, or *orbital* nerve; the ſecond, the *ſuperior maxillary*; and the third, the *inferior maxillary*.

The *Orbital* Nerve gives off one branch, or more, near its origin, to a branch of the ſixth pair, that, both together, they may form the great intercoſtal nerve; it afterwards paſſes through the orbital fiſſure, where it is immediately ſubdivided into three branches; the frontal, the lacrymal, and the external naſal.

The *Frontal* Branch runs along forwards in the ſuperior part of the orbit, and gives off branches in its courſe to the *perioſteum* and *elevator palpabrae ſuperioris* muſcle: it goes out through the ſuperciliary *foramen*, and diſappears in the muſcles and integuments of the forehead.

The *Lacrymal* Branch proceeds forwards, on the external ſide of the orbit, to the lacrymal gland.

The *Naſal* Branch is the lowermoſt branch of the orbital nerve. It ſends a ſmall twig to form the ophthalmic ganglion, then goes forwards towards the inner *canthus* of the eye, and there gives a branch or two, which returns into the *cranium* through the internal orbital *foramen*, and returns again with the olfactory nerves into the noſtrils, through the cribriform plate of the *os ethmoides*, and is loſt in the pituitary membrane.

There are other branches which go to the lacrymal ſac and duct, and to the *caruncula lacrymalis*.

In the bottom of the orbit, as already noticed, there ariſes from the conjunction of a twig of the naſal branch with a branch of the ſecond pair, a whitiſh red, and round ganglion, which is called the lenticular, or ophthalmic ganglion. Various ſmall branches ariſe from this ganglion, and are loſt in the *tunica ſclerotica*, and *choroidea*, and likewiſe in the *uvea* and ciliary ligament.

The *Superior Maxillary Nerve*, or the ſecond branch of the fifth pair, is larger than the orbital nerve. It goes out of the ſkull through the *foramen rotundum*, and there ſends a ſmall branch, which paſſes through the maxillary bone, and is connected with the *portio dura* of the auditory nerve. It is afterwards divided into three branches, viz.

1. The *Sphoenopalatine Branch*, which goes through the *foramen* between the *oſſa palatinum* and *ſphenoidale*, ſends ramifications to the *pterygoideus internus* muſcle, and then enters the cavity of the noſtrils, where it is diſtributed in the pituitary ſinus of the ſphenoid bone, in the Euſtachian tube, and partly alſo in the ſoft palate. Moreover a branch comes from it, which is often divided into two leſs, goes to the orifice of the carotic canal, and is there joined with one or two branches of the ſixth pair of nerves; ſo that the great intercoſtal nerve is hereby formed. Another branch paſſes through the middle pterygoid *foramen*, and is joined with the inferior maxillary nerve.

2. The *Poſterior Alveolar Nerve*. This deſcends directly, and paſſes into ſome branches, of which one enters the maxillary cavity, through the *foramen*, ſituated over the laſt grinding tooth, is diſtributed to the grinders, and communicates with the anterior alveolar

nerve.

nerve. The other leſs branches go to the *buccinator* muſcle.

3. The *Infraorbital Nerve*, which is the third branch of the ſuperior maxillary nerve, enters the orbital canal, through the inferior orbital foramen, and gives various branches, in its courſe, to the grinding teeth, and other parts of the upper jaw. It then goes out again through the anterior orbital *foramen*, is diſtributed in the muſcles of the cheeks, noſe, and lips, and communicates, here and there, with ſmall branches of the *portio dura* of the auditory nerve.

The *Inferior Maxillary* Nerve is the third and largeſt branch of the fifth pair. It paſſes out of the *cranium* by an oval *foramen*, and gives ramifications to the muſcles and glands in its courſe. It is often connected with branches of the *portio dura* of the auditory nerve. Whilſt it is going to the internal ſurface of the lower jaw over the pterygoid muſcle, it is divided into two branches;

1. The *Internal Lingual*, which is the leſs nerve. This is connected with the nerve that conſtitutes the *chorda tympani*, near the *pterygoideus internus* muſcle; and is diſtributed to the ſublingual glands and contiguous muſcles, more eſpecially to the tongue; where, alſo, it frequently communicates with branches of the ninth pair.

2. The *More Proper Inferior Maxillary* Nerve; or, the ſecond and larger branch. This deſcends between the external and inter-

nal pterygoid muſcles to the poſterior maxillary foramen, and paſſes by it into the maxillary canal, where it gives a twig to each tooth. Having gone out through the anterior maxillary foramen, it affords branches to the lower lip and chin.

The *Nerves of the ſixth pair*, or the *Abducentes*, ariſe between the *corpora pyramidalia* of the *medulla oblongata* and the *pons*, then proceed forwards, perforate the *dura mater*, and are inſerted into the ſpongy ſinus near the *ſella turcica:* they there ſend ſome branches which are united with branches of the inferior maxillary nerve, near the carotic canal, that by their union the great intercoſtal nerve may be formed.

Now theſe nerves of the ſixth pair go out with the third and fourth pair through the ſuperior orbital fiſſure, and are diſtributed in the *rectus externus* muſcle of the bulb of the eye.

The *Nerves of the ſeventh pair*, or the *Auditory* nerves, are divided on each ſide into two branches: the poſterior, larger and ſofter part, is called *Portio Mollis*, and the leſs, *Portio Dura* of the auditory nerve. Both go to the *os petroſum*.

The *Portio Mollis* ariſes from the *medulla oblongata* and fourth ventricle of the brain, enters the internal auditory paſſage through the ſmall *foramina* in the cavity of the *os petroſum*, and is diſtributed by innumerable branches, not only to the *cochlea*, but alſo to *veſtibulum*; where it lies in the membrane lining the *veſtibulum*, and the ſemicircular canals.

The *Portio Dura* ariſes, near the *pons*, from the *crus* of the brain, and paſſes to the cavity of the *os petroſum* through a particular *foramen*, (which is the beginning of the aqueduct of Fallopius, running on the internal and anterior ſurface of the *os petroſum*, as far as the cavity of the *tympanum*, extending through its poſterior part, and at length terminating in the ſtylo-maſtoid *foramen*, behind the condyle of the lower jaw). The *portio dura* meaſures this canal; but where the canal is turned downwards, it ſends a ſmall branch, through another canal, into the *tympanum*, which aſcends between the *malleus* and *incus*, over the *membrana tympani*, and is called *Chorda tympani* (330). It goes out of the *tympanum* ſuperiorly through a fiſſure behind the articulation of the lower jaw, and is united with the ſmall lingual nerve. The principal trunk of the *portio dura* paſſes the aqueduct of Fallopius, goes out through the ſtylo-maſtoid *foramen*, gives various branches to the external ear and parotid gland, and having paſſed through the parotid gland, is expanded on the face in ſeven or eight branches, which conſtitute what is called the *Pes Anſerinus*. This becomes larger, is extended forward, backwards, and upwards towards the temples, and communicates with the three branches of the fifth pair, with the eight pair of the brain, and with the third cervical pair.

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(330) Mr. Hunter ſays—" I am almoſt certain it *(Chorda Tympani)* is not a branch of the ſeventh pair of nerves, but the laſt deſcribed branch from the fifth pair (See Note 330.); for I think I have been able to ſeparate this branch from the *portio dura*, and have found it lead to the *chorda tympani*; perhaps is continued into it: but this is a point very difficult to determine, as the *portio dura* is a very compact nerve, and not ſo faſciculated as ſome others are, &c. (Obſ. on the An. Oecon. p. 220.)."

The *Nerves of the eighth pair*, or the *Par Vagum*, ariſes by numerous beginnings, partly from the *medulla oblongata*, and partly from the fourth ventricle behind the *pons*, between the *tubercula olivaria* and *pyramidalia*. It is joined immediately at its origin with the *nervi acceſſorii* of Willis. Theſe nerves ariſe from the fifth cervical nerve, or the ſixth ſuperior and hindermoſt; they aſcend laterally, in the direction of the *vertebrae* of the neck, into the cranium, through the great foramen of the *os occipitis*, and are there connected with the eighth pair, but not intimately joined with them; connected thus together, they deſcend with the internal jugular vein, go out of the cranium through the *foramen lacerum* on each ſide, then ſeparate from the eighth pair, and vaniſh in the maſtoid and *cucullaris* muſcle.

The eighth pair, at its egreſs from the cranium, gives off various branches, the chief of which, in the neck, go to the tongue, pharynx, larynx and thyroid gland; from which ſeveral parts they acquire names. They

are

are united with the branches of the fifth pair, the *portio dura* of the auditory nerve, the recurrent nerve, the great intercoſtal nerve, the ninth pair of nerves and all thoſe of the neck. Having beſtowed theſe branches, they deſcend into the cavity of the thorax (331). In

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(331) Mr. Hunter, who has written on ſome branches, not commonly known, of this pair, obſerves of the courſe of this branch, after its coming to the cribriform plate of the ethmoid bone, that it paſſes down through one of the anterior holes of the cribriform plate, and that after having continued its courſe in a groove on the naſal proceſs of the frontal bone, it runs forwards and downwards in a ſimilar groove on the inſide of the *os naſi*; from thence getting on the outſide of the cavity of the noſe, it runs along the cartilaginous part of the *ala*, and near the extremity of the noſe, mounts up upon the tip of the *ala*, and then dipping down between the two *alae*, is loſt on the anterior extremity of the cartilaginous *ſeptum*. He alſo ſays, that, in its courſe, it ſends ſeveral ſmall filaments into the *alae* (On the An. Oec. p. 219.). Now former Anatomiſts believed this branch to go to the membrane of the noſe for the ſenſe of ſmelling; but it is now clear that it only paſſes through that membrane to its deſtined place.

Another nerve deſcribed by Mr. Hunter, which paſſes through the membrane of the noſe, and was ſuppoſed by ſome to terminate there, ariſes from the ſuperior maxillary nerve; which, as he ſays—" having paſſed through the *foramen rotundum*, divides and ſends off ſeveral branches, one of which paſſes backwards and inwards through the *foramen commune*, between the orbitar proceſs of the palate, and the root of the ala of the ſphenoid bone, a branch of which gets into a fiſſure, and ſeems to ſeparate the root of the ala from the body of the ſphenoid bone, where that bone makes the roof of the noſe. This branch then paſſes along the under ſurface of the body of the ſphenoid bone, in its way to the *ſeptum*

In the cavity of the thorax, the trunk of the *par vagum* emits the following branches:

1. The *Right* and *Left Recurrent Nerve.* The *Right* ariſes, on the right, at the ſubclavian artery, which it ſurrounds, and then returns upwards to the thyroid gland. The *Left* ariſes ſomewhat inferiorly, under the

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tum narium, and getting upon that part, paſſes along between its membranes and the bone: its courſe is downwards and forwards, towards the *foramen inciſivum*, through which it paſſes, and is loſt in the gum behind the firſt dentes inciſores, and on the membrane of the roof of the mouth at that part (p. 220.)."

Another branch of the ſuperior maxillary nerve, which comes off from a large branch going down to the mouth, *uvula*, &c. and its diviſion into two, has been deſcribed by Profeſſor Meckel of Berlin, who traced one of the branches into the portio dura, and no further. Mr. Hunter ſays—" This branch of the ſuperior maxillary nerve paſſes back through the foramen pterigoideum, accompanies the carotid artery as it paſſes acroſs the poſterior edge of the foramen, and there divides into two branches; one of which paſſes down along with the carotid artery through the baſis of the ſkull, and proceeding in a contrary direction to the courſe of the artery, in contact with that branch of the cervical ganglion that paſſes up with the carotid artery to join the ſixth pair; then joins the firſt cervical ganglion. The other branch decuſſates that artery on its upper ſurface, and getting upon the anterior ſide of the petrous portion of the temporal bone, enters a hole near the bottom of that large one, which affords a paſſage to the ſeventh pair of nerves, joining the portio dura, juſt where that nerve makes its firſt turn, paſſes along with it through what is called the aquaeduct. This nerve, compoſed of portio dura and the branch of the fifth pair, ſends off in the adult, the chorda tympani before its exit from the ſkull, and in foetus immediately after (Hunter, p. 220.).

arch of the *Aorta*, which it ſurrounds, and then aſcends with the *oeſophagus* as far as the larynx. They are both diſtributed to the muſcles of the larynx and pharynx.

2. At the origin of the recurrent nerves, many other branches ariſe, to be conjoined with numerous ramifications from the great intercoſtal nerve, with the ſuperior, middle and lowermoſt cervical ganglion; alſo, with the recurrent and diaphragmatic nerves, and the firſt pair of cervical nerves. All the nerves now mentioned come together, on the ſuperior ſide of the *pericardium*, and conſtitute the *Cardiac Plexus*. Some branches aſcend from hence, between the *aorta* and pulmonary artery, and follow the courſe of the right coronary artery to the heart, and are diſſeminated in the right and left ventricles of the heart, in the external ſurface of the heart, and the adjacent parts.

3. Now the trunk of the eighth pair extends on the poſterior ſurface of the lungs, on each ſide, and ſends off ſome branches, which are joined with others coming from the cardiac *plexus* and the recurrent nerves. Hence there ariſes a *right* and *left pulmonic plexus*, diſtributed alike to the lungs and *aſpera arteria*.

4. Both trunks of the eight pair then deſcend with the *oeſophagus*, in ſuch a manner, that the right branch is placed on its poſterior ſurface, and the left on its anterior, where they give many ramifications, which united

conſtitute the *Oeſophagean Plexus*; from which there go nerves into the *oeſophagus* and adjoining parts.

5. At length the trunks deſcend through the diaphragm, with the *oeſophagus*, to the ſtomach, and there they form the Two *Stomachic Plexus* about the ſuperior orifice of the ſtomach, by the union of their branches. The anterior *plexus*, which is the leſs, is expanded over the anterior ſurface of the ſtomach and its greater arch; the poſterior and larger *plexus* is diſtributed over the poſterior ſurface and the leſs arch, and ſends off branches to the liver, pancreas and diaphragm.

6. Some branches of this nerve are alſo united with the branches of the great intercoſtal nerve, and ſo concur to form the hepatic, ſplenic, renal plexus, &c.

The *Ninth and laſt pair of nerves is the Lingual.* Theſe ariſe from the *medulla oblongata*, between the *corpora olivaria* and *pyramidalia*, paſs out of the ſkull through the anterior foramina of the condyloid proceſſes of the *os occipitis*, and communicate with the eighth pair of the cerebral, and the firſt pair of the cervical nerves. Then they go forward, between the jugular vein and carotid artery, and ſomewhat upward near the angle of the lower jaw; here they are inclined inward, and diſtributed to the ſubſtance and muſcles of the tongue and *os hyoides*, where they are joined with other nerves belonging to the tongue.

It appears from this deſcription, that only the Olfactory, the Optic, and the *Oculorum motorii*, or the firſt, ſecond and third pairs, ariſe from the whole brain and that the *trochleatores* and *trigemini*, or the fourth and fifth, from the *cerebellum*; but that all the reſt, or the ſixth, ſeventh, eighth and ninth pairs, ariſe from thoſe places, where the medullary ſubſtance of the brain is united with that of the *cerebellum.*

The *Great Intercoſtal Nerve*, or the *Great Sympathetic Nerve*, as it is called, becauſe of its connection with moſt other nerves, ariſes neither from the brain, nor from the cerebellum, nor from the *medulla oblongata*, but from a branch of the ſixth pair, to which a twig of the ſecond branch of the fifth pair is united, at the carotic *foramen*; from the junction of theſe two branches the Great Intercoſtal Nerve is formed, which deſcends through the carotic foramen between the bodies and tranſverſe proceſſes of the cervical *vertebrae.* As it deſcends, it is enlarged by filaments from all the cervical nerves, and with them it forms the *Three Cervical Ganglions.*

The *Uppermoſt ganglion* of the neck is ſituated upon the ſecond cervical *vertebra*, behind the pharynx; it ſends ſome branches to concur in forming the pulmonic and cardiac *plexus*, and others, which are united with the lingual nerve, the eighth pair, and the other two cervical ganglions.

The *Middle Ganglion* of the neck is ſituated on the fourth cervical *vertebra.*

The *Lowermoſt* Cervical ganglion is the leaſt of the three. It is placed laterally on the laſt *vertebra* of the neck, paſſes downwards, and ſurrounds the ſubclavian artery.

From this cervical ganglion there ariſe many branches, which are joined with others of the eighth pair, forming that juſtly remarkable *plexus* called *Cardiac.*

The trunk of the intercoſtal nerve deſcends from the ſide of the tranſverſe proceſſes of the dorſal *vertebrae*, behind the ſubclavian artery, and through the cavity of the thorax. Each of the dorſal nerves, which come from the ſpinal marrow, ſends two branches to it; with which it conſtitutes ſo many ganglions. It then paſſes, along with the aorta, from the ſide of the lumbar *vertebrae* and *os ſacrum*, and produces various ganglions with the nervous branches of thoſe bones, as far as the extremity of the *os coccygis*, where it is inflected inward and joined with its fellow.

There are five branches, eſpecially to be noticed, in the thorax, from which there ariſe rather inferiorly the ſemilunar ganglions. The firſt of theſe branches ariſes from the fifth dorſal ganglion; the ſecond from the third, the third from the ſeventh, the fourth from the eighth, and the fifth from the ninth, tenth, and ſometimes from the eleventh.

Theſe branches deſcend in the courſe of the *vertebrae* of the back, and paſs through the diaphragm, where they unite into one trunk, on both ſides, called the *Splanchnic*, or *Little*, or *Anterior*, *Intercoſtal Nerve*. Each trunk immediately under the diaphragm produces the great *ſemilunar ganglion*, laterally on the anterior ſide of the aorta; from which ſome ſmall nervous filaments come and unite to form the *Solar Plexus*. From the two ſemilunar ganglions there ariſe likewiſe many branches to be joined with others from the ſolar plexus, and to concur to form the abdominal plexus.

The *Firſt abdominal plexus*, is the *Cœliac*. It ariſes from the union of the branches of the ſolar plexus with thoſe of the ſemilunar ganglion.

The *Second* is the *Hepatic Plexus*. It ariſes from branches of the abdominal plexus, and of the right ſemilunar ganglion, and affords nerves for the *vena portarum*, gall-bladder, liver, *duodenum*, and *omentum*.

The *Third* is the *Splenic Plexus*, which ariſes alſo from the abdominal plexus and the right ſemilunar ganglion. It goes, together with the veſſels, through the great notch into the ſubſtance of the ſpleen, and ſends branches to the ſtomach and pancreas.

The *Fourth* is the *Superior Meſenteric Plexus*. It ariſes from the union of the branches of the two ſemilunar ganglions, the ſolal and abdominal *plexus*. It ſends branches to the ſuperior part of the meſentery, the meſocolon,

colon, and meſenteric glands. Some branches ſurround the meſenteric artery like a net (332).

The *Fifth* is the *Renal Plexus*, which ariſes from branches of the ſemilular ganglions and the ſuperior meſenteric and ſuperlumbar plexus. It is diſtributed to the kidneys and renal glands. Some branches of this, and the preceding plexus, deſcend near the aorta, to form the inferior and poſterior meſenteric plexus.

The *Sixth* is the *Inferior Meſenteric Plexus*, and

The *Seventh* is the *Meſocolic*, or *Poſterior Meſenteric Plexus*. They ariſe from the branches of the ſuperior meſenteric and renal plexus, which run over the aorta, and both ſend branches into the menſentery and inteſtines.

The *Eighth* is the *Hypogaſtric Plexus*. It ariſes from the branches of the ſuperior and inferior meſenteric plexus, which unite together on each ſide, at the fourth *vertebra* of the loins.

This plexus is divided into two branches ſomewhat lower down, each of which ſwells from its ſide into the *plane Ganglion*, the branches of which go to the contiguous parts, the *inteſtinum rectum*, urinary bladder, ſpermatic glands, proſtrate gland and *uterus*.

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(332) The Nerves from this net-like courſe over the arteries, are probably deſtined to moderate the force of the blood going to the inteſtines, and to give ſenſibility to the inteſtines themſelves; for the meſentery and the meſenteric glands are not very ſenſible, and there are no muſcular fibres in either.

The *Ninth* is the *Spermatic Plexus*. It ariſes from the meſenteric plexus, which is connected with the lumbar and ſacral nerves. It ſends branches to the ſpermatic veſſels, the *teſtes* and *ovaria*.

It appears then from the origin and connection of theſe plexus, that in general they all communicate with one another, either immediately, or by means of *viſcera*; and that they ſend all their branches into the *viſcera* of the abdomen.

Nerves of the Spinal Marrow.

The nerves which ariſe from the ſpinal marrow, and go out through the lateral foramina of the cervical, dorſal and lumbar *vertebrae*, and alſo through thoſe of the *os ſacrum*, are called *Spinal Nerves*. Each of theſe nerves ariſes from the ſpinal marrow by two roots, one anterior and another poſterior, which unite laterally, and form a ſmall ganglion every where, before they go off from the vertebral canal.

The Superior Spinal Nerves come from the *vertebrae* in a courſe ſomewhat tranſverſe, but the inferior come more obliquely downwards from the foramina of the *vertebrae*, the more they deſcend. The ſuperior are the leſs; the inferior are the thicker and larger, except the two lowermoſt ſacral nerves. As ſoon as each trunk has ariſen from a ganglion, it ſends off two branches; one of which is joined to its ſuperior fellow, the other to its inferior; and it alſo ſends off two other branches which are united with the Intercoſtal nerves.

They are all covered with *dura* and *pia mater*, even to their ultimate terminations.

The Spinal Nerves are divided into

1. Eight	pair of	Cervical	Nerves.
2. Twelve		Dorſal	
3. Five		Lumbar	
4. Five		Sacral	

Of the Cervical Nerves.

The Firſt pair of cervical nerves, which are conſidered by ſome as the tenth pair of the cerebral, ariſes immediately under the great occipital *foramen*, at the beginning of the ſpinal marrow; it then paſſes laterally between the margin of this foramen and the firſt *vertebra* of the neck, from behind, forwards. Upon the tranſverſe proceſs of the firſt cervical *vertebra*, it forms a ganglion with ſome branches of the ſecond cervical nerve, from which the occipital nerve ariſes, and paſſes through the lateral foramen.

The ſecond pair of cervical nerves goes out between the firſt and ſecond *vertebræ* of the neck, and is diſtributed, together with the firſt pair, to the muſcles of the head and neck, and to the parotid gland and external ear. Moreover, it ſends a twig to the acceſſory nerve of Willis.

The Third Pair goes out between the ſecond and third *vertebrae* of the neck, and is diſtributed by branches in the common integuments of the *ſcapula*, *cucullaris* muſcle, and *triangularis* muſcle of the arm. It ſends ſome ſmall branches to form the diaphragmatic nerve.

The Fourth, Fifth, Sixth, Seventh and Eighth Pairs of the neck, all come together, and conſtitute the *Brachial Plexus*; from which the ſix brachial nerves ariſe.

The *Acceſſory Nerve of Willis* ariſes, on both ſides, from the conjunction of the branches of the ſecond, fourth, and fifth pair of cervical nerves, and, as was before obſerved, returns to the brain; from whence it again goes out together with the eighth pair, and is diſtributed to the *cucullaris* muſcle.

The *Diaphragmatic*, or *Phrenic Nerve* ariſes, on both ſides, from the union of the branches of the third, fourth and fifth cervical pairs; it is indeed enlarged by one branch coming from the firſt pair of the nerves of the back, and another from the great intercoſtal nerve. It then goes, between the clavicle and ſubclavian artery, into the cavity of the breaſt to the *pericardium*, and deſcends from thence to the upper ſurface of the diaphragm,

phragm, in which it diſappears by minutely ramifying (333).

The *Brachial Plexus* ariſes from the union of the five lowermoſt cervical nerves, and a large branch of the firſt pair of the back, in the ſuperior part of the ſhoulder, between the clavicle and *ſcapula*.

From this plexus, independent of the many ſmall branches, immediately at its origin, which go into contiguous parts, there ariſe the ſix following principal branches, to be diſtributed to the ſuperior extremities, viz.

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(333) Wriſberg ſays the origin of the phrenic nerve is not certainly extended above the third or fourth cervical pair; he ſaw a variety five times in diſſecting thirty-ſeven bodies, in which the phrenic nerve was connected with the ninth pair of cerebral nerves by a deſcending branch (*Comment. Soc. Reg. Scient. Gotting.* 1779, 1780, *pag.* 86.).

The phrenic nerves being *irritated*, the diaphragm is contracted, and made to deſcend into the *abdomen*. If the phrenic nerves be *compreſſed*, *tied*, or *divided*, whether in the neck or in the thorax, the diaphragm becomes paralytic, and reſpiration ceaſes. Or, if any breathing remain, it is produced by the intercoſtal muſcles alone, and is altogether inſufficient to ſupport life. For, if the ſpinal marrow be divided below the ſixth *vertebra*, thoracic breathing ceaſes, though abdominal breathing continues, the origin of the phrenic nerves being higher.

But the diaphragm receives other nerves from the ſtomachic *plexus* of the eighth pair, and from the *plexus* of the ſplanchnic nerve, at the origin of the cœliac artery. Some nerves alſo come to the diaphragm from the lowermoſt dorſal, and the uppermoſt lumbar nerves (Marherr in Boerhaave, § 597.). See the note on the diaphragm, in the Myology.

1. The Axillary, or Articular Nerve.
2. The External Cutaneous }
3. The Internal Cutaneous } of the Arm.
4. The Median.
5. The Ulnar, or Cubital.
6. The Radial.

The *Axillary Nerve* runs backwards and outwards from its origin, and ſurrounds the neck of the *os humeri*. It is diſtributed throughout the *triangularis* muſcle of the arm, and the adjacent muſcles of the *ſcapula*, by numerous ramifications. It oftentimes ariſes from the radial nerve, and not from the brachial plexus.

The *External Cutaneous Nerve of the Arm* goes through the ſuperior part of the *coraco-brachialis* muſcle, perforates it obliquely downwards, and gives branches to it. This nerve then deſcends, between the *biceps* and *internus* muſcles of the arm, to the flexure of the cubit, but is covered inferiorly only with common integuments (334). Having paſſed the flexure, it goes, near the median vein, under the ſkin on the outſide of the fore-arm, as far as the thumb, where it is ſeen no more, becauſe of its minute diviſion into ſmall filaments.

The *Internal Cutaneous Nerve of the Arm*, which is ſmall, deſcends on the inſide of the

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(334) The bad effects which ſome have aſſigned to a wound of the tendon of the *biceps* muſcle, in opening the median vein, are ſaid by Haller to proceed from pricking this nerve (*Sur les part. ſenſ. et irrit.*).

humerus, covered by ſkin and muſcles. As it deſcends, it divides into two branches, which both together go to the flexure of the cubit; but afterwards the anterior branch runs, near the baſilic vein, as it is called, under the ſkin and between the *palmaris longus* and *radialis internus*, even to the palm of the hand, into the ſkin of which it is inſerted; the poſterior branch runs, along the internal ſurface of the fore-arm, to the little finger, and diſappears in the ſkin.

The *Median Nerve* deſcends, with the brachial artery, on the internal ſide of the *biceps brachii* muſcle, to the cubit; it thence paſſes the length of the fore-arm, between the *brachiaeus internus* muſcle, the *pronator rotundus*, and between the *perforatus* and *perforans* of the fingers, under the internal ligament of the wriſt, into the palm of the hand. It gives off ſmall twigs, on all ſides, to the muſcles of the hand.

The ultimate branches, of the median nerve, conſtitute the *Digital Nerves*. Theſe run from each ſide of the thumb, fore-finger, middle finger, and, from one ſide of the ring finger, as far as the utmoſt extremities of the fingers, giving many ſmall branches to the ſkin, tendons and ligaments, in their courſe.

The *Cubital Nerve* deſcends, on the inſide of the fore-arm, between the brachial artery and the baſilic vein; then, under the ſkin, between the internal condyle of the *humerus*

and

and the *olecranon*; and more inferiorly, from the ſide of the *cubitaeus internus* muſcles, along the courſe of the fore-arm, in the anterior extremity of which, it divides into two branches.

The Internal greater branch is named the *Internal Cubital Nerve.* It paſſes over the internal ligament of the wriſt, and the internal ſurface of the ſeſamoid bone of the wriſt, to the hand, where it is again divided into three branches, the two former of which go from the ſides to the extremities of the ring and the little finger; the third makes an arch towards the thumb, in the palm of the hand, is joined with a branch of the median nerve, and loſt in the contiguous muſcles.

The External ſmaller branch, or *External Cubital Nerve* paſſing over the tendon of the *cubitaeus externus* muſcle, and the back of the hand, arrives at the two laſt fingers, and diſperſes itſelf, in ramifications, through the convex ſurface of theſe fingers.

The *Radial Nerve*, immediately at its origin, paſſes backwards about the *os humeri*, and deſcends from thence, on the outſide of the *humerus*, between the *brachiaeus internus* and *internus* muſcles, even to the cubit. It then goes between the *ſupinator longus* and *brevis* of the hand to the poſterior or ſuperior extremity of the *radius.* In this courſe, it ſends various branches into adjacent muſcles, and is divided into two branches, in the place already mentioned; the leſs of which goes along the *radius*, between the *ſupinator longus* muſcle, and the *radiaeus externus*, to the back of the hand, and ends in the interoſſeous muſcles, the thumb and the three firſt fingers. The larger branch paſſes between the poſterior extremity of the *radius* and the *ſupinator brevis* muſcle, and eſcapes our ſight in the muſcles of the fore-arm.

Some of the brachial nerves now mentioned communicate with one another in different places.

The Dorſal Nerves.

We have already ſaid that there are twelve pairs of *Dorſal Nerves*; all of which give off various branches to the muſcles of the back, as they paſs out of the foramina of the dorſal *vertebrae*. Hence they go inwards, by the inferior margin of the ribs as far as the *ſternum*; but the five inferior pairs go to the cartilaginous proceſſes of the ribs: they are called *Coſtal Nerves*; the ſuperior are diſtributed to the intercoſtal muſcles, the *ſerrati* and inferior pectoral muſcles; they go likewiſe to the abdominal muſcles, the diaphragm and common integuments. The firſt pair gives a branch to the brachial plexus.

The Lumbar Nerves.

We have already noticed that there are five pairs of *lumbar nerves.* Theſe go out of the lateral foramina of the *vetebrae* of the loins, and are beſtowed on the loins, the oſſa ilii, and the muſcles of the abdomen. They ſend ſome branches, with the ſpermatic cord to the *ſcrotum*; and in women to the *ovaria:* ſome are likewiſe ſent into the groins, and ſuperior muſcles of the thigh; ſome run to the diaphragm; and branches are ſent away from the whole five pairs, into the great intercoſtal nerve, as already noticed.

From the union of the ſecond, third, and fifth lumbar nerves, ariſes on each ſide the *Obturator Nerve*, which deſcends on the internal ſide of the pſoas muſcle into the *pelvis*; perforates the *obturator* muſcles; goes out through the ſuperior notch of the *foramen ovale* of the *os innominatum*, and is diſtributed, by ſmall branches, to the *obturator* muſcles, the *triceps femoris*, the *pectineus*, &c.

The third and fourth pairs of the Loins, together with ſome branches of the ſecond pair, conſtitute the *Crural Nerve.*

The *Anterior*, or *Middle Crural Nerve* ariſes from the union of the branches of the third and fourth lumbar nerves, and likewiſe of ſome ramifications of the ſecond and fifth. It paſſes over the *os ilium*, under the *pſoas* muſcle, and Poupart's ligament, and goes out of the *pelvis*, on the external ſide of the crural artery. It afterwards gives off many branches, ſome of which are ſent to the inguinal glands, and others to the muſcles of the thigh; but a great part of them are diſtributed in the common integuments, the broad *faſcia* and ſkin, in which laſt they become inviſible. One branch of this anterior crural Nerve deſcends in the direction of the *ſartorius* muſcle, as far as the internal condyle of the *os femoris*; from thence it paſſes near the *vena ſaphena*, on the inſide of the leg, to the internal ancle; and, laſtly, to the great toe, where it is implanted in the ſkin.

The fifth pair of nerves of the loins is joined particularly to the firſt pair of the ſacral nerves.

The Sacral Nerves.

Of the *Sacral Nerves*, by which is meant the *Nerves of the os ſacrum*, there are only five pairs, all of which originate in the *cauda equina*, as it is called, of the ſpinal marrow; and go out through the anterior foramina of the *os ſacrum*. The firſt four of theſe nerves give off ſome branches to the contained parts of the *pelvis*, and are afterwards united with the laſt lumbar pair to form a thick, large, nervous plexus, from whence the great iſchiatic nerve ariſes. The fifth pair is almoſt wholly diſtributed to the *inteſtinum rectum*, the neck of the urinary bladder, the *urethra*, the *corpora cavernoſa penis*, and the *uterus* and *vagina* of women.

The *Iſchiatic Nerve*, or the *poſterior crural Nerve*, is the largeſt nerve in the body. It ariſes, as we have obſerved, from the plexus formed by the junction of the firſt four ſacral nerves with the laſt lumbar pair. It immediately ſends branches to the urinary bladder, the inteſtinum rectum, and the genitals; after which it deſcends through the notch of the *os ilii*, between the tuberoſity of the *iſchium* and the greater trochanter, on the poſterior part of the thigh, to the ham. Having arrived at this place, it changes its name for that of *popliteal* Nerve, and then ſoon divides into two branches, of which

1. The *Peroneal* Nerve is the exterior and ſmaller,

2. The *Tibial* is the interior and ſtronger.

The *Peroneal Nerve* deſcends externally on the fibula, is turned forwards at the inferior part of this bone, and after giving off branches to the contiguous muſcles, is divided into two, of which the external branch paſſes under the aponeuroſis to the external ancle, and is expanded on the back of the foot and ſkin. The internal branch goes to the interior parts and the muſcles of the foot; ſome of its ramifications being continued in the toes.

The *Tibial Nerve* deſcends behind the *popliteus* muſcle, between the two *gaſtrocnemii*; it perforates the inferior *gaſtrocnemius*, and goes between it and the *flexor longus* of the toes, to the extremity of the *tibia*; giving off many branches to the contiguous muſcles and ſkin. One branch perforates the interoſſeous ligament, deſcends to the external ancle, and afterwards paſſes, upon the back of the foot, to the two laſt toes, and communicates oftentimes with the peroneal nerve. The chief branch leads behind the internal ancle, through a notch in the *os calcaneum*, to the ſole of the foot; where it is divided into two branches, which are called the *Plantar Nerves.*

The *External Plantar Nerve* runs along on the external ſide of the ſole of the foot, and gives many branches to the muſcles and aponeuroſis on the bottom of the foot.

The *Internal Plantar Nerve* goes on the internal ſide of the ſole of the foot, and both theſe nerves are united, like the cubital and median nerves in the palm of the hand; and as theſe latter are diſtributed to the palm of the hand and the fingers, ſo thoſe are diſtributed to the ſole of the foot and the toes.

OF THE

GLANDS

IN GENERAL.

A GLAND is a firm, round, or oblong, organic part, encloſed in a proper membrane, compoſed of arteries, veins, and nerves, and deſtined for the ſecretion or alteration of ſome determinate liquor (335).

Glands

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(335) This is certainly as good a definition of a gland as has hitherto been given by any Anatomiſt. The antients had no definite idea of a gland (Heiſter, *Comp. Anat. Adenologia.)*: for they ſeem not to have acknowledged the liver or brain to be glandular. Prof. Leber's definition excludes the ſpleen, and every other part that ſecretes nothing from the blood, from the catalogue of glands; yet it comprehends the *thymus*, the thyroide gland, &c. the uſe of which is doubtful.

As to the fabric of glands, there are too different opinions, the one of Malpighi, the other of Ruyſch; each of theſe has its favourers *(Epiſtolae Boerh. et Ruyſchii, de Fabrica Gland. in C. H.)*.—Malpighi ſuppoſed that an artery enters a gland, ramifies through its ſubſtance, and terminates in branches in a veſicular cavity or follicle; from which follicle is continued an excretory canal to diſcharge the ſecreted liquor. He thought a follicle

to

Glands are divided into different claſſes, either according to their fabric, or the liquor they contain.

to exiſt in every *acinus*, and that ſecretion is performed, after the ſame manner, in ſimple and in compound glands. His proofs in ſupport of this hypotheſis were few, and that few was taken from morbid appearances. Boerhaave taught Malpighi's doctrine a long time, but relinquiſhed it after peruſing Ruyſch's objections to it, in his letter above alluded to.

Ruyſch's refutation of the doctrine of Malpighi ſeemed ſo clear and ſatisfactory, that Boerhaave became a proſelyte, and moſt people now agree with Ruyſch. This is the opinion of Ruyſch: the glands, ſaid he, are not formed of follicles, though I own follicles to exiſt in ſome parts, but of veſſels coiled up, &c. Malpighi, ſaid he, thought the blood to paſs into follicles, and to be retained and changed in them; but I think that the extremities of arteries form the fluids from the blood (p. 77.). Ruyſch was led to his doctrine by the art of injecting, which he practiſed with ſuch uncommon ſkill, as to demonſtrate veſſels, where veſſels had been thought not to exiſt.

The compound glands, when examined, may be ſeen to conſiſt of Arteries, Veins, Nerves, Lymphatics, and excretory ducts. The *Arteries going to glands* ſeem to be more irritable than elſewhere, and ſometimes their courſe is remarkable.

The *Veins of Glands* are without valves, except in the teſticles. The *Lymphatics* are generally very numerous, and their uſe is probably to abſorb the more fluid part of the ſecreted fluids. The *Excretory Duct* is of a ſtronger texture than either arteries or veins; it is even tendinous, though it generally has muſcular fibres in it. The branches of the excretory duct is obvious enough, as it ramifies through glands, having either one centre of ramification, or two, as in the liver.

The proper membrane, or covering of a gland is ſometimes eaſily ſeparated, as from the Liver, Kidney, &c. but ſometimes it cannot be ſeparated without tearing the gland, as is the caſe of the *pancreas*.

According to their fabric, they are diſtinguiſhed into four claſſes :

1. Simple Glands,
2. Compounds of ſimple Glands,
3. Conglobate Glands,
4. Conglomerate Glands.

According to their fluid contents, they are more properly divided into

1. Mucous Glands,
2. Sebaceous Glands,
3. Lymphatic Glands,
4. Salival Glands,
5. Lacrymal Glands.

I.

Simple Glands are ſmall, hollow, follicles, covered with a peculiar membrane, and having a proper excretory duct, through which they evacuate the liquor contained in their cavity. To this claſs may be referred the *mucous glands* of the noſe, tongue, *fauces*, *aſpera arteria*, ſtomach, inteſtines, and urinary bladder : alſo the *ſebaceous glands* placed about the *anus*, and the ſmall glands which ſecrete ear-wax in the *Meatus Auditorius Externus*.

Theſe ſimple glands are either diſperſed here and there, or are contiguous one to another, forming a heap, in ſuch a manner, that they are not covered by a common membrane, but each hath its own excretory duct, which is never joined to the excretory duct of another gland. The former are called *Glandulae Simplices*

plices Solitariae ; the latter, *Glandulae Simplices Adgregatae*, or *Congregatae.* Of this kind are the *Glandulae Congregatae Peyerianae* of the ſmall inteſtines, &c. To this kind alſo belong ſuch collections of glands as are included in another common membrane, beſides that which is proper to them ; and each of which exonerates itſelf by means of its excretory duct, into ſome mucous or pituitous cavity: ſuch are called *Glandulae Conglutinatae* ; e. g. the Tonſils.

II.

The *Compound Glands* conſiſt of many ſimple glands, the excretory ducts of which are joined in one common excretory duct ; ſuch are the numerous ſebaceous glands of the face, lips, palate, and various parts of the ſkin, eſpecially of the *pubes.*

III.

Conglobate Glands, or Lymphatic Glands, ſo called, are thoſe into which lymphatic veſſels enter, and from which they go out again. Such are the meſenteric glands, and all the other lymphatic glands, of the loins, groins, arm-pits, &c. Some of them alſo occur about the larger trunks of the veins. They are compoſed of a texture of lymphatic veſſels, connected together by cellular membrane. It muſt be obſerved, they have no excretory ducts ; they are largeſt in *foetus*, they become ſmaller after birth, and nearly vaniſh in adults (336).

IV.

Conglomerate Glands are compoſed of a congeries of many ſimple glands, the excretory ducts of which open into one common trunk: theſe are likewiſe covered by a common cellular tunic. Of this kind is the Parotid Gland, the Pancreas, and all the ſalival glands. They differ but little from the compound glands; yet they are compoſed of more ſimple glands than the compound. The leaſt bodies of theſe glands are encloſed in cellular membrane, and are compoſed of ſmaller *acini*, as appears to an obſerver.

Beſides, there are many conglomerate glands, the excretory ducts of which have never yet been detected: e. g. the thyroid gland, and the ſupra-renal glands.

The *Excretory Duct of a Gland* is the duct through which the liquor of a gland is excreted.

The *Veſſels* and *Nerves* of Glands always come from adjacent parts.

The *Uſe* of the Glands is to ſeparate a peculiar liquor, or, to change it (337). As for the contained in veſſels which communicate with the arteries and veins, and are continuous with them; and ſince the appearance of theſe fluids ceaſes ſoon after their communication with the blood is intercepted.

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(336) The ſtructure of lymphatic glands is ſpoken of, in ſpeaking of the glands of the meſentery.

(337) The hiſtory of the blood and of the glands is already delivered. I ſhall next take a ſummary review of the fluids that are found in different parts of the body, and differ one from another in certain particulars. That the fluids, now alluded to, exiſt in the blood, previous to their ſeparation, can hardly be doubted, ſince they are

But although theſe fluids, all of them, may be conſidered as exiſting previouſly in the blood-veſſels; yet ſome of them only are perfect there, as the Perſpirable Matter, Urine, and the Fluid of Cavities. For Bile, Ear-wax, Semen, Fat, and ſeveral others, do not exiſt perfectly formed in the blood; their elements only being there uncombined.

Now the Fluids of the firſt claſs, being perfect in the blood, and mixed mechanically with it, may eaſily be ſeparated by a mechanical *apparatus*. And, accordingly, we find that thoſe branches of arteries which are too ſmall to receive red blood, can nevertheleſs ſerve for the tranſmiſſion of its more fluid tranſparent part.

It is very different with reſpect to the fluids of the ſecond claſs. They never exiſt perfectly formed in the blood, nor are they ever mixed with it in health. The appearance of theſe can probably be only brought about by a peculiar organization, very different from that of ſimple mechaniſm. It is this organization which, I think, may properly be called a *Gland*.

Of the circumſtances that affect ſecretion, the chief are 1. The Quantity of blood, 2. The Quality of the Blood, and 3. The ſtate of the Veſſels that perform ſecretion.

The *Quantity of Blood*. Where the quantity of blood is great, there the ſecretion may alſo be great; eſpecially of the fluids of the firſt claſs.

The *Quality of the Blood* likewiſe has more influence on the ſecretion of the fluids of the firſt claſs, though it may perhaps affect the ſecretion of thoſe of the ſecond, in ſome meaſure. The quality here alluded to depends on the proportion of water to the other parts of the blood. Other qualities may influence it; but they are few in number, and precarious in effect.

Moreover, except the matter of perſpiration, urine, and milk, the other ſecretions are ſcarcely, if at all, influenced; unleſs the quality of the blood be ſuch as to operate in a particular manner on the glands.

The *Action of the Heart and Arteries* has no effect on any of the ſecretions, except that of perſpirable matter.

the uſe of the conglobate glands it is entirely unknown (338).

The

The Mind can nevertheleſs influence almoſt all the ſecretions; as can alſo ſtimulants applied to glands, or their ducts.

Between the ſecretions of Perſpirable Matter and Urine there is a great connection, or ſympathy, ſo that when the one is diminiſhed, the other is encreaſed, and *vice verſa*.

(338) As I deſign not to give a hiſtory of opinions concerning the uſe of the conglobate glands, but only that which ſeems, to me, moſt reaſonable; I have ſelected Doctor Johnſtone's. Leſt, however, I ſhould any way miſconceive and miſrepreſent his meaning, I will copy his very words; —" When we conſider theſe various facts, that all lymphatic veſſels perpetually enter the conglobate glands, and in the cells of which theſe glands univerſally conſiſt, depoſite the lymph, which, being abſorbed, once and again by larger lymphatics, is, at length, conveyed, by the great canal, the lacteal duct, into the vena cava deſcendens, under the left clavicle. When we recollect, that the venereal virus, cancerous, and variolous poiſons, enter the body by theſe channels, and are primarily depoſited in theſe glands, occaſioning tumours, ſometimes indolent, ſometimes painful, inflamed, and ſuppurating. It ſeems clear theſe glands are intended by nature to purify the lymph, before it enters the veſſels, from matter which may be noxious there, by arreſting it in the glands univerſally connected with the abſorbents. In theſe glands it is either altered by a concocting or digeſting power inherent in them; or when it is too noxious to be ſubdued into a ſalutary nature, it remains in the form of a tumour, or eſcapes by ſuppuration. When it cannot be ſubdued, nor removed by ſuppuration, and thoſe ſalutary effects of nature fail, it is then abſorbed, and diffuſes diſeaſe in the conſtitution at large (Account of the Walton Waters, near Tewkſbury, &c. p. 34.)."——Another uſe of the lymphatic glands, as well as of the ſpleen, is imagined by Dr. Crawford (Exp. and Obſ. on Animal Heat, &c.): but as this uſe cannot be underſtood but by thoſe

who

The Glands contained in the Cavity of the Skull.

1. The *Glands of the Dura Mater* are oval, commonly white, but ſometimes red. They are placed in the courſe of the ſuperior longitudinal *ſinus* of the *dura mater*, and without it, in particular cavities of the *os frontis* and *oſſa ſincipitis*; and alſo under the *ſinus*, mentioned in the *pia mater*. Some alſo occur in the tranſverſe *ſeptum.*

2. The *Glands of the Plexus Choroides*, which are conglobate. They are found in the ventricles of the brain, and are for the moſt part connected to the *plexus choroides.*

3. The *Pituitary Gland*, which is ſeated in the excavation of the *ſella turcica*, where the *infundibulum cerebri* ends: it is covered by the *pia mater*, and the inner *lamina* of the *dura mater*. A Gland it is not, but a part of the brain itſelf. The ancients called it the pituitary gland, becauſe they believed that *pituita* was diſtilled through it into the noſtrils from the brain.

4. The *Pineal Gland*, which is not a gland, but a medullary protuberance in the middle between the the *tubercula quadrigemina* (339).

The

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who know his chemical theories, which I could not adduce here, I chuſe rather to refer my reader to his book.

(339) This gland, or whatever elſe it may be, for it has various names, is perhaps always preſent, as well in man as in woman, in children as in adults. It does not depend on diſeaſe. It was once found hollow (*Diſſ. Inaug.*

Anat.

The Glands of the Eyes.

1. The *Glandulae Meibomianae*, of which there are thirty or forty, placed in a ſingle or double row along the internal margin of the eye-lids, under the ſkin, which is perforated by their excretory ducts on the edge of the *tarſi.*

2. The *Lacrymal Gland*, which is of the conglomerate kind, ſituated in a particular excavation of the *os frontis*, in the orbit, above, the external *canthus:* it has ſix or ſeven excretory ducts, which run along the *tunica adnata* of the eye-lids, and open near the cartilaginous *tarſus.* This gland ſecretes an aqueous, ſaltiſh liquor, that always moiſtens the eye, and flows in *Tears* when ſecreted in an unuſual quantity.

3. The *Glands of the Caruncula Lacrymalis:* theſe are ſmall ſebaceous glands, covered by the *caruncula lacrymalis*, in the inner *canthus*, and ſecreting a viſcid liquid, to ſupply the

Anat. de Lapillis vel prope vel intra glandulam pinealem ſitis, &c. Praeſide D^{re}. Sam. Thom. Soemmerring, *reſp.* Nicolao Liſignolo. *Moguntiae* 1785.). It is larger in the ox, aſs, ſheep, ſtag, &c. than in the human ſpecies, though the brain of all theſe animals is leſs than that of man.

Near the baſe of this gland, or within it, from the fourteenth year, is a little heap of ſtones, ſometimes larger than at other times: the larger ſtones are generally in the middle ſurrounded by the ſmaller, ſo that it is properly enough called *Acervulus.* Theſe ſtones are not of a bony nature: they ſink quickly in water.

want of Meibomian Glands. There are ſmall hairs ariſing from the glands of the *caruncula lacrymalis*, which defend the *puncta lacrymalia* from duſt, and the inſpiſſated liquor of the lacrymal gland; ſo that the ſordes of the eyes may be collected in the inner *canthus*.

The Glands of the Noſtrils.

The *Mucous Glands of the pituitary membrane of the Noſtrils* are ſmall, placed here and there over the pituitary membrane, eſpecially near the *ſeptum narium*, ſeparating *mucus*.

The Glands of the Ears.

The *Ceruminous Glands of the external ear* are ſmall and yellow, ſituated under the ſkin, in the *meatus auditorius externus*, and deſtined to ſecrete the ear-wax.

The Glands of the Mouth.

1. The *Parotid Glands* are two large conglomerate glands, on each ſide, occupying the whole ſpace, under the ear, between the maſtoid proceſs, and the angle of the lower jaw, and extended anteriorly to the *maſſeter* muſcle, and ſuperiorly to the zygomatic proceſs. All the ſmall excretory ducts of the glands come together to form a larger duct, of a white colour, which is called from its inventor the *Stenonian Salival Duct*. This

duct, endowed with very many veſſels, ariſes from the bottom of the gland, and aſcends a little at its beginning; then it paſſes anteriorly, in a tranſverſe courſe, over the ſurface of the *maſſeter* muſcle, and deſcends to perforate the *buccinator*, and laſtly, opens into the mouth, between the glands of the checks, at about the ſecond or third *molares* teeth.

Superiorly, at the beginning of the *maſſeter* muſcle, there is another conglomerate gland, which is ſometimes united to the parotid; but the duct of this is always joined to the Stenonian duct. Moreover, there are two, three, or more lymphatic glands, which have no excretory duct, and of conſequence, are never united with the above-mentioned ſalival duct.

2. The *Maxillary Glands*, which are two of the conglomerate kind, lie on each ſide, at the internal angle of the lower jaw, under the *mylohyoideus* and *ceratogloſſus* covered with the ſkin; their excretory duct, paſſing between the ſublingual muſcles, is called *Ductus Whartonius:* this duct opens anteriorly on the ſides of the ſublingual *froenulum.*

3. The *Sublingual Glands* are two oblong, narrow, conglomerate glands, ſeated upon the *mylohyoideus* muſcle, under the tongue, between the internal ſurface of the lower jaw, and the tongue; they open on the ſides of the tongue by fifteen or twenty excretory ducts. Beſides, they have another excretory duct, which is ge-

nerally united with the Whartonian duct, but is ſometimes ſeparate, opening laterally on the tongue.

4. The *Glandulae Buccales*, or *Genales*, which are ſmall ſimple glands, diſpoſed in branches near the opening of Steno's duct. Some of them alſo lie between the *maſſeter* and *buccinator* muſcles.

5. The *Labial Glands*, which are ſmall, like the former, lying on the inſide of the lips. They pour out a liquor like *ſaliva*, into the mouth.

6. The *Glandulae Molares*, one on each ſide, between the *maſſeter* and *buccinator* muſcles; they are compound ſalival glands, and open by their duct at the laſt grinding tooth.

The Glands of the Fauces.

On the inner membrane of the mouth and fauces, which is a continuation of the pituitary membrane of the noſtrils, there are ſituated numerous mucilaginous glands; the chief of which are theſe:

1. The *Glands of the Palate*, which are ſmall, and diſperſed all over the ſurface, but eſpecially the poſterior part of the palate.

2. The *Glands of the Uvula*, which are very numerous about the *uvula*; theſe are mucous glands.

3. The *Tonſils*, or *Amygdalae*, ſo called from the reſemblance; they are two mucous

glands, one of which is placed on each ſide behind the two arches of the *velum pendulum palati*, where they pour out a mucilaginous liquor through ſmall excretory ducts.

4. The numerous *Mucous Glands* in the root of the tongue, opening by their excretory ducts into the *foramen coecum* of the tongue, as it is called.

The External and Internal Glands of the Neck.

1. The *Thyroide Gland*, which is large, and placed anteriorly in the neck, covering ſuperiorly the lateral parts of the thyroide cartilage, with its two *cornua*, or proceſſes; and inferiorly, the cricoide cartilage, and top of the *aſpera arteria*. It contains a watery, viſcid liquor. It is uncertain whether this is of the conglobate or conglomerate kind of glands: its uſe is likewiſe unknown, its excretory ducts having never been detected.

2. The *Jugular Glands* are in number from fourteen to twenty-four; they ought to be referred to the conglobate kind; they lie near the external jugular veins, covered by the ſkin of the neck.

3. The *Cervical*, or *Occipital Glands*, which are conglobate glands, placed on the back and ſides of the neck. In children theſe often become tumid.

4. The *Laryngeal Glands*, which are ſimple mucous glands, lying in the internal mem-

brane of the *rima glottidis*, and ſecreting a mucilaginous liquor.

5. The *Pharyngeal* and *Oeſophageal Glands* placed in the internal membrane of the pharynx and *oeſophagus*, and preparing a liquor, like that of the former glands.

The Glands of the Thorax.

1. The *Thymus:* this gland is of a ſoft and rare texture; its ſituation is in the anterior hollow ſpace, below the ſuperior part of the *ſternum*.

It is extended, both above and below, into two *cornua*; it is largeſt in *foetus*, ſoft and filled with a white watery fluid (340). In adults it is ſmall, hard, and diſappears by degrees. As nobody has hitherto found its excretory duct, ſo we neither know to which kind of glands it belongs, nor what uſe nature deſigned it for (341).

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(340) Spirit of Wine added to the liquor, contained in this gland, coagulates it *(in grumos cogit)* *(El. Phyſ. Halleri, T.* III. *p.* 116.).

(341) Wriſberg ſays, this gland is ſometimes found very large in adults *(Deſcrip. Anat. Emb Obſ.* V. § 13.): and Morgagni ſaw it of a conſiderable ſize, in a girl of thirteen years old, who had been ſick from her cradle, and died after having laboured of *dyſpnoea*, cough, and expectoration, *aſcites*, &c *(De Sed. et Cauſ. Morb. Epiſt.* 17. n. 10.). Heiſter ſaw the ſame in a boy thirteen years old, who died of a hectic fever *(Comp. Anat. Ed. Norimb.* 4to.). As to the figure of this gland, it is various. In *foetus* it

2. The *Bronchial Glands* are ſometimes larger and ſometimes ſmaller, of a bluiſh or blackiſh colour, ſeated at the inferior extremity of the *aſpera arteria*, where the *aſpera arteria* is divided into two branches; they lie in the cellular texture, anteriorly and poſteriorly, between the external and ſecond coats. Their ducts perforate the *aſpera arteria*, and pour into its cavity a blackiſh liquor. Some of theſe glands may alſo be ſeen in the *bronchiae* (342).

3. The *Gland of the back of the Oeſophagus.* When this is preſent, its ſeat is about the fourth or fifth *vertebra* of the back, externally on the backſide of the *oeſophagus*. There are ſometimes two of theſe glands. The excretory duct remains to be inveſtigated (343).

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it ſometimes reaches as high as the thyroide gland (*Morg. Ad. Anat.* V. *Animad.* XIII.); and its uſe is ſaid by Senac to conſiſt in its filling up the cavity of the breaſt, before the lungs are expanded with air (*Traite du Coeur, T.* II. *p.* 688.). Perhaps its gradual decreaſe depends not only on the action of the lungs in reſpiration, but alſo on the cauſe, whatever it is, of the decreaſe of all the glands in the advance towards old age.

(342) Why theſe glands are of a blue or black colour, or whence the blueneſs or blackneſs of their contents is derived, it is undetermined (See Cruikſhank on the Abſorb. Syſt. p. 69.). Mr. Portal conſiders the bronchial glands as different from the lymphatic glands of the lungs (*Mem. de l'Acad. Roy. Paris.* 1780.): but this does not ſeem likely.

(343) M. Vicq d'Azyr ſays that there are glands at the bottom of the *oeſophagus* of dogs, that ſecrete a part of the gaſtric liquor (*Hiſtoire de l'Acad. Royale des Sciences, Tome* 68.). Is the gaſtric liquor furniſhed by ſuch glands in man?

4. The *Mammary Glands.* Theſe are numerous and ſmall. They occupy the adipoſe membrane of the breaſts, and their gliſtening ducts terminate in the nipples. In women, theſe glands ſecrete the milk of the breaſts.

The Glands of the Abdomen.

In the cavity of the abdomen, there are the following:

1. The *Pancreas* (³⁴⁴).

2. The *Gaſtric Glands,* which are ſmall and ſimple, in the third cellular texture of the ſtomach, eſpecially near its right orifice. The excretory ducts of theſe glands open into the ſtomach.

3. The *Inteſtinal Glands*, which are ſimple, and are as well *ſolitariae*, that is, placed here and there, as heaped up like a bunch of grapes; the former are called *Brannerian Glands*, the latter *Peyerian.* They are ſituated in the ſmall and large inteſtines, between the villous and nervous coats, and their office is to ſecrete a *mucus* into the inteſtines. Theſe glands are moſt numerous in the *inteſtinum ileum* (³⁴⁵).

4. The *Meſenteric Glands* are very numerous, ſoft, and conglobate, between the *laminae* of the meſentery, of various ſize and poſition. In theſe glands, are inſerted beſides lymphatic

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(³⁴⁴) I have not given the deſcription of the pancreas here, becauſe it is expected in the Splanchnology.

(³⁴⁵) The glands of the inteſtines are ſpoken of in the Splanchnology.

veſſels returning from the lower extremities, the lacteals of the ſmall inteſtines; but theſe latter go out from the oppoſite ſide of the glands, in their road to the *receptaculum chyli.* Theſe are true lymphatic glands, in which, it ſeems, the chyle is diluted, and thus changed in ſome manner (345).

5. The

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(346) Almoſt as ſoon as the lacteals come to the meſentery they enter its glands. The meſenteric glands are a part of the abſorbing ſyſtem. They are Lymphatic Glands. The *Figure* of the lymphatic glands is often triangular, but oftener oblong, one ending being turned towards the thoracic duct; ſometimes they are flat, globular, and of very indeterminate figure. The *Size* is alſo various, as well in different bodies, as in different parts of the ſame body, and in the different periods of life. Their *Colour* too is uncertain: in infants it is generally red, but as age advances, they become white. They are redder under the ſkin, than in the thorax or abdomen. Whilſt chyle is paſſing through the meſentery, the colour of the glands is white.—The lymphatic glands are covered externally with a tunic, ſomewhat like the teſticles; their appearance is ſmooth and gliſtening. Like the teſticles, the lymphatic glands of the groin and axilla may be drawn out of their tunics. This tunic is not fibrous, nor is it diviſible into membranes. It adheres to the ſubſtance of the gland by cellular membrane, which likewiſe connects the cells of the gland together, and is pervaded with a liquor generally of a white colour. This white liquor is found in the cellular membrane of all the lymphatic glands, even of thoſe moſt remote from the route of the chyle. This liquor is certainly not of the ſame nature as that in the proper cells of the glands. It does not ſeem likely that its globules ſhould ever become the red particles of the blood (See Cruikſhank on the Lymphatic Glands, p. 70.).—The *Arteries* of Lymphatic glands come commonly in all directions from the contiguous parts (*Ruyſchii Epiſt. Anat. ad Boerh. p.* 79.):

5. The *Cyſtic Glands*, which are ſmall, of an obſcure brown colour, ſimple, and placed under the inmoſt coat of the gall bladder, eſpecially about its neck, and the common biliary duct. They ſecrete a *mucus* into the gall bladder by their excretory ducts.

Abdominal Glands without the Peritoneum.

1. The Supra-renal Glands, or *Capſulae atrabiliariae*, or *Renes ſuccenturiati*. In *foetus* they contain a yellow, red fluid. More may be ſeen of theſe glands in the Splanchnology.

2. The *Lumbar Glands*, which are ſmall and conglobate, ſituated about the *receptaculum chyli*.

3. The *Sacral Glands*, adhering to the *os ſacrum*; and

4. The *Iliac Glands*, which are placed at the origin of the veſſels of the *pelvis*. Both of theſe glands are ſmall, conglobate, lymphatic glands, which receive the abſorbents of the lower extremities, going to the *receptaculum chyli*.

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the *Veins* alſo which have no valves, have a ſimilar origin, and both ramify throughout the whole of each gland.

The *Nerves* of lymphatic glands are very ſmall.

Lymphatic glands are covered externally by a minute net-work of lymphatic veſſels (Cruikſhank, p. 70.).

Lymphatic glands do not ſeem to be formed of convolutions of the *vaſa inferentia*; they ſeem to be cellular, for it is eaſy to fill theſe glands by firſt puncturing them, and then forcing air or mercury into them, their cells communicating one with another.

The Glands of the Genitals of Man.

1. The *Proſtate Gland:* this is a very firm and compact gland, ſituated poſteriorly on the *rectum*, and anteriorly under the neck of the bladder. Its figure is that of an heart; it is broad towards the bladder, and thick, and notched, and narrow towards the *glans penis.* It altogether ſurrounds the *urethra* as far as the bulb, and is firmly united to it by cellular membrane, and to the urinary bladder by means of fleſhy fibres. Its upper ſurface, turned towards the *ſymphyſis pubis*, is ſmooth, having in its middle a groove, in which lies the *vena penis.* The number of its excretory ducts is from ten to twelve, all of them opening anteriorly at the *caput gallinaginis*, and evacuating a whitiſh viſcid liquor into the *urethra*, as often as it is neceſſary.—In women, there is no proſtate gland.——The fabric and uſe of its fluid is not yet found out.

2. *Two Large Conglomerate Glands*, one adhering on each ſide, behind the bulb of the *urethra*; they run forwards open into the *urethra*, and pour forth a viſcid liquor.

3. The *Mucous Glands of the Urethra:* theſe are numerous, but ſmall. They are placed under the internal membrane of the *urethra*, and ſecrete a viſcid liquor into its cavity to defend its inner membrane from any kind of acrimony. The other glands of

the *urethra* deſcribed by ſome Anatomiſts, I have never yet ſeen.

4. The *Odoriferous Glands of the Penis* are ſmall, ſimple, and ſebaceous, ſecreting an unctuous liquid, of a peculiar odour, about the *collum et corona glandis penis.*

The Glands of the Genitals of Woman.

1. The *Odoriferous Glands of the Labia majora* and *Nymphae*, which are ſebaceous, and placed on the internal ſurface of the *Labii Vulvae et Nympharum*; they ſecrete an unctuous liquor of a peculiar odour.

2. The *Odoriferous Glands of the Clitoris:* theſe are placed at the baſe of the *clitoris*, and are of the ſame nature as the former.

3. The *Mucous Glands of the Urethra:* theſe are like the mucous glands in the *urethra* of men.

4. The *Glands of the Vagina*, which are mucous, lying under the inmoſt coat of the *vagina*, and depoſiting in the *vagina* their *mucus*. The mucous glands, which lie in the poſterior part of the *vagina*, are called from him who diſcovered them *Bartholinian*.

The Glands of the Extremities.

1. The *Axillary glands*, which are lymphatic, lying in the cavity under the arm, near the large axillary veſſels, between the

tendons of the *pectoralis major*, and the *latiſſimus dorſi* muſcles. Theſe glands receive lymphatic veſſels returning from the ſuperior extremities, and from the *mammae*.

2. The *Inguinal Glands*, which are alſo to be referred to the lymphatic kind. Theſe are in great number, on both ſides, at the inferior part of the groins, under the ſkin, in the cellular membrane. Their lymphatic veſſels come from the *penis*, and partly from the lower extremities.

3. The *Mucilaginous*, or *Synovial Glands* of Havers, who diſcovered them. They are ſoft and tender, and contained in almoſt every joint. The largeſt are in the depreſſion of the *acetabulum* of the *os innominatum*, into which the *os femoris* is inſerted (347). They ſecrete an unctuous, lubricating fluid into the above-mentioned cavities, which lubricating fluid mixed with the oily moiſture that exhales from the ends of the bones, and the watery moiſture of the ligaments, conſtitutes *Synovia*; the uſe of which is to lubricate the articulations, and to preſerve and render them moveable.

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(347) Though called Glands, yet they are nothing but adipoſe membrane. (See Note 142.).

The Glands of the Skin.

The *Cuticular Glands* are ſmall and ſebaceous, lying on the internal ſurface of the ſkin, perforating the ſkin with their excretory ducts, and opening upon the *epidermis*, where they diffuſe a lubricating fluid, by means of which the ſkin is kept ſoft. Theſe Glands are diſperſed throughout the whole ſurface of the body; but they are more numerous in ſome parts than in others. They are moſt numerous about the noſe, ears, *ſcrotum*, &c.

SPLANCHNOLOGY.

The Diviſion of the Human Body.

THE Human Body is commonly divided into
The *Head*,
The *Trunk*, and
The *Extremities*, or *Limbs*.
The *Head* is again divided into
The *Face*, and
The *Hairy Scalp*.
In the *Face* are to be remarked
The *Forehead*,
The *Temples*,
The *Ears*,
The *Eyes*,
The *Mouth*,
The *Chin*, and
The *Cheeks*; of which laſt, the poſterior parts, in men, are adorned with a *beard*.
In the *Hairy Scalp* may be noticed
The Fore part,
The Hinder part,
The Temples.

The Trunk is divided into
The *Neck*,
The *Thorax*, and
The *Abdomen*.

In the *Neck* the *anterior part* ſhould be noticed; for the *head of the aſpera arteria* is there more prominent in men than in women, and is called *Pomum Adami*.

In the *poſterior part* of the neck, the *Nape*, and Lateral Parts are conſpicuous.

The *Thorax* is divided into

The *Anterior Part*, upon which the *Breaſts* are placed. The *Scrobiculus Cordis* is that depreſſion, or little hollow, under the *ſternum*, at the bottom of the *thorax*.

The *Poſterior Part*, or the *Back*,
The *Two Lateral Parts*.

The *Abdomen* is divided into

The *Fore part*, which is properly called the *Abdomen*.

The *Poſterior part*, or the Loins,
The *Two Lateral Parts*.

The Anterior Part of the *abdomen* is ſubdivided into four regions:

1. The *Epigaſtric Region*, the lateral parts of which are called *Hypochondria*, is extended from the *ſcrobiculus cordis* to three fingers breadth above the navel.

2. The *Umbilical Region*, the lateral parts of which are called the *Lumbar Regions*, is deſcribed by a circumference extending three fingers above and below the navel.

3. The *Hypogaſtric Region*, the lateral parts

of which are called the *Iliac Regions*, begins at a diſtance of three fingers breadth, below the navel, and extends as far down as the region of the *pubis*.

4. The *Region of the Pubis* is covered with hair, in adults. Its lateral parts are called the *Inguinal Regions*, or the *Groins*. The Genitals of both ſexes are placed below the region of the *pubis*.

That part which is ſituated between the genitals and the orifice of the *anus*, is called *Perinaeum*.

The *Limbs*, or *Extremities*, are divided into *ſuperior* and *inferior*.

Each ſuperior extremity is divided into

The *Top of the Shoulder*, under which is the *ſubaxillary hollow*, or the *axilla*:

The *Arm*,

The *Fore arm*, in which we may remark the *flexure*, and the *elbow*,

The *Hand*, the principal parts of which are the *Palm* and *Back*.

The *Hand* is ſubdivided into

The *Carpus*,
The *Metacarpus*,
The *Fingers*.

The *Fingers* are divided into

The *Thumb*,
The *Fore Finger*,
The *Middle Finger*,
The *Ring Finger*,
The *Little Finger*.

Each inferior extremity is divided into

The *Thigh*, the ſuperior and exterior part of which is called the *Iſchiatic Region*.

The *Leg*; to which may be referred

The *Knee*,

The *Ham*, and

The *Calf of the Leg*.

The *Bottom of the Foot*, of which the chief parts are the *Sole* and *Back*. At its beginning are the *Internal* and *External Ancles*.

The Bottom of the foot is divided into

The *Tarſus*,

The *Metatarſus*, and

The *Toes*.

The Common Integuments of the Body: the Hair and Nails.

Every part of the human body is covered by a common tegument, which is generally called the *Skin*.

Anatomiſts refer to the Skin,

1. The *Epidermis*,
2. The *True Skin*,
3. The *Adipoſe Membrane*,
4. The *Nails*, and
5. The *Hair*.

The *Epidermis* is a tranſparent, inſenſible membrane, which covers the ſkin, and adheres to it, by means of many hairs and veſſels which paſs through it

Nevertheleſs itſelf is altogether deſtitute of veſſels and nerves.

Its *external ſurface* is dry and ſomewhat like horn; it is incorruptible, marked with many lines, and porous. Its *internal ſurface*, in Europeans, is ſoft, almoſt fluid, and commonly mucilaginous, forming only one *lamina* with the external ſurface; but, in Ethiopians, this internal ſurface is firm and membranous, and may eaſily be ſeparated from the external even in a healthy ſtate (348). It has ſmall depreſſions for the reception of the nervous *papillae*, which are conſpicuous on the external ſurface of the ſkin (349). This internal *lamina* is called *Rete Malpighianum.* The *epidermis* not only covers the whole external ſurface of the body, but the internal parts are covered by it; for it affords a covering for the *inteſtinum rectum*, the *vagina*, the *urethra*, the noſtrils, the mouth, the ears, and the eyes (350). In ſome parts of the body it is thicker, in others it is thinner. In places which are burnt, or expoſed to much friction, new *laminae* ariſe between the *epidermis* and *cutis*; hence it becomes thicker, and thus *Callus* is formed (351).

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(348) Concerning the modes of ſeparating the *epidermis* from the *cutis*, and the *corpus reticulare*, which is between both, connecting them together, it may ſhortly be remarked, that, *in living parts*, ſuch ſeparation may be effected by mere preſſure or friction, and by epiſpaſtics: *in dead parts*, it is beſt done by maceration in warm water (*Albinus Acad. Annot. Lib.* I. *Cap.* I. and *Heiſteri Comp. Anat. de Splanch. Gareng.*).

Becauſe the cuticle ſometimes peels off from the *foetus*, it has been imagined that it is an infallible ſign of its being dead; but it is very fallible, if we can credit the authorities of Albinus (*Acad. Annot. Lib.* I. *Cap* I.), Saviard (*Obſ. Chir.* XCVII.), Smellie (Treat. on the Theory and Pract. of Midwifery, Vol. I. Chap. III. Sect. V. Numb. i.), Roederer (*Elem. Art. Obſtet.* § 385. *γ.*) De Meza (*Tract. de Quibuſdam notab. objectis ad Art. Obſtet. ſpect. Cap.* V. § 80. 3.), Hebenſtreit (*Diſſ. de Capitonibus laborioſo partu naſcentibus*, § XVII.), &c.

(349) Malpighi averred that the *epidermis* and *corpus mucoſum* have numerous *foramina* (*De Org. Tact. Ext.*), formed by the pyramidal *papillae* of the *cutis*; but this is denied by Albinus (*Ac. Annot. Lib.* I.), and Haller (*Pr. Lin. Phyſ.* § 425.). Albinus ſays, however, there are depreſſions (*Foveoli, Vaginulae*, &c.), which correſpond to, and contain the *papillae* of the ſkin, as a ſcabbard corref-

The *Fabric of the Epidermis* appears to conſiſt of the external part of the Malpighian *mucus*, condenſed by the air and attrition. This *mucus*, which, as we have obſerved, is alſo called *Rete Malpighianum*, ſeems to be a fluid ſecreted by cutaneous veſſels, and inſpiſſated (352). There can be no doubt but
that

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correſponds to, and contains a ſword. That the *rete mucoſum* is not perforated may be ſeen eſpecially in Æthiopians.—Soemmering, whom I have already mentioned, has obſerved that the *Rete Malpighianum* can only be gotten, free from the ſkin and cuticle, and in the form of a membrane, in the *Scrotum* of Ethiopians.

(350) Ruyſch calls the *epidermis* of internal parts *Epithelium.*

(351) Kaaw, Boerhaave, and others have remarked, that the cuticle of the palm of the hand, and the ſole of the foot, is thicker in a *foetus* than that of other parts.

(352) The generation and regeneration of the cuticle have been variouſly explained. Heiſter ſays, that Lewenhoeck believed it to be formed of an expanſion of the excretory ducts of the ſkin; and Ruyſch ſuppoſed it formed of an expanſion of the nervous *papillae* of the ſkin, which form numerous very ſmall *ſquamulae* cohering together (*Comp. Anat.* § 196.). It is alſo noticed by Heiſter, that the opinion of Morgagni (*Adv. Anat.* II. *An.* III.), who

that the colour of the body depends upon it; ſince it is brown in Ethiopians, and white in Europeans (353).

The

ſuppoſed it to be formed of the ſurface of the ſkin hardened firſt by the conſtant and uniform preſſure of the *liquor amnii*, and afterwards of the atmoſphere, is without foundation. For to Heiſter it ſeemed improbable, that the liquor *in utero* can ſo preſs the ſkin as to produce a cuticle of ſuch tenacity and inſenſibility as it uſually is (*Comp. An. Nota* 2 *.). Heiſter himſelf aſſigns it not to either the cauſe of Lewenhoeck, or Ruyſch, ſeparately, but to both conjunctly.

The cuticle is readily regenerated, as we ſee, in the healing of ſlight wounds every day. The *Rete Malpighianum* is alſo regenerated, for, in Ethiopians, the pits left by the ſmall pox, though white at firſt, become black afterwards.

(353) The colour of the ſkin, as it conſtitutes a principal variety in men that inhabit different regions of the earth, has always been a ſubject of much contemplation. Malpighi, who obſerved that the cuticle and *cutis* are both white, attributed it to the *corpus mucoſum (De Org. Tact. Ext.)*; and the greater number of phyſiologiſts are of his opinion.

Mankind differ in colour, in form, in ſtature, and in their manners, in all the intermediate degrees between the Eaſt and the Weſt, and the North and the South. Buffon has elegantly deſcribed theſe differences. Doctor Hunter made ſeven varieties of mankind, founded on their colour only (*Theſis inauguralis De Variet. Hom. &c. Edinb.* 1775.); and Blumenbach has made only five, founded on the colour of the ſkin, and the formation of the face and ſtature. His *firſt Variety* comprehends the inhabitants of all Europe, of the weſtern part of Aſia, and of the northern part of Africa, the inhabitants of Greenland and of Eſquimaux. Theſe have a white ſkin, and a beautiful form. The *ſecond Variety* comprehends the inhabitants of the other parts of Aſia, who are of a brown colour verging to olive, having their faces flat, their eye-brows ſmall, and their hair thin. This variety he ſubdivides into two, the one comprehending the *northern*, and the other, the *ſouthern* people. His *third Variety* comprehends all the inhabitants of Africa,

except

The *Skin* properly ſo called is only cellular ſubſtance cloſely compacted together, ſituated between the *epidermis* and adipoſe membrane. It is elaſtic, ſenſible, extremely porous, compoſed of nerves, arteries, veins, and lymphaties.

Like the *epidermis* it covers the whole body. Its external ſurface, which is contiguous to the internal ſurface of the *epidermis*, is the more denſe of the two; and we can every where detect in it by touch, but eſpecially in the extremities of the fingers, ſmall obtuſe *papillae*, compoſed of veſſels and nerves, and a texture uniting them all together. Theſe are called *Nervous Papillae*. The internal ſurface of the ſkin, which is next the adipoſe membrane, is thinner than the external, and

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except the northern. Theſe, he obſerves, differ ſo much, that you may know them at firſt ſight from Europeans. Their upper jaw projects, their lips are large and tumid, their noſe is like that of an ape, their ſkin is black, the hair of their heads is very black, and ſhort and curling, and they are very fleſhy. The *fourth Variety* comprehends the people of Ameirca, whoſe colour is like that of copper, whoſe ſtature is ſlender, and whoſe hair is thin. Laſtly, the *fifth Variety* comprehends the people of the Pacific Ocean, whoſe colour is very brown, whoſe noſe is very flat, and whoſe nair—the hair of the head—is very thick (*De Hum. Gen. Variet. nat. Goet.* 1781.).

I ſay nothing of Linne's diſtinction of mankind into Europeans, Africans, Aſiatics, and Americans, becauſe, I think, it is juſtly rejected by Zimmerman, Metzer, and others.

The cauſe ſeems to be the conjunct action of Climate, Mode of Living, Food, &c. but how the effect is produced, it is hard to determine. Conſult Buffon's *Hiſtoire Naturelle*; Clarkſon's Eſſay on the Slavery and Commerce of the Human ſpecies; Smith's Eſſay on the Cauſes of the Variety of Complection and Figure in the Human Species, &c.

has many ſmall depreſſions for the reception of the eminences of the adipoſe membrane.

Between the internal ſurface of the ſkin and the adipoſe membrane, there are ſituated, here and there, many ſebaceous glands, not only ſimple, but alſo compound; the excretory ducts of which perforate the ſkin, open on the *epidermis*, and there ſeparate a fat, ſoft or viſcid liquid, to defend the parts from air and friction (354). The bulbs of the hair are likewiſe ſituated in this place, and each hair ariſing from its bulb, perforates the ſkin. It muſt however be obſerved, that the ſkin is more delicate in ſome places than in others; that its hardneſs and ſtrength differ according to age, manner of living, &c.

The *Arteries* of the ſkin are ſmall and ſhort, and always ariſe from the larger arteries under the ſkin (355).

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(354) Perhaps there cannot be a more ſatisfactory proof that there is no tranſudation through the cuticle, even in dead bodies, than what every one muſt have taken notice of, who was ever employed in diſſecting: it is this, that if a portion of a dead body be preſerved with the cuticle entire, even if it be placed before the fire, yet it will continue as moiſt as ever; but if the cuticle be taken off, and the part expoſed to heat, it ſoon dries and becomes horny.—The *Phenomena* of veſication are a demonſtrable proof that in a living body there is no tranſudation through the cuticle (Med. Obſ. and Inq. Vol. 2. p. 47.). Therefore the ſebaceous matter ſo conſtantly found upon the cuticle, but in greater quantity in ſome places than in others, is not tranſuded, but poured out by the ducts of the glands mentioned in the text.

The ſkin of a *fœtus* is of a bright red colour, eſpecially in the face and head. This redneſs ſeems to depend, in ſome meaſure upon its greater vaſcularity, but chiefly upon the difficulty of parturition, during which the return of the blood from the head is greatly impeded by the different poſitions of the *fœtus*.

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(355) Malpighi *(De Ext. Tact. Org.)* Boerhaave *(Inſt. Med.* § 424.*)*, and Steno *(Epiſt. ad Barthol. Cent.* 3. *No.* 65.*)* believed that the matter of perſpiration is evacuated by the ducts of glands placed under the ſkin; but Ruyſch denied that the glands alluded to are to be found every where under the ſkin *(Theſ.* 10. *No.* 120. *Ep. ad* Boerh. *p.* 53. 54. 58.*)*. They are not at the tips of the fingers, from which ſweat flows in very great abundance.

Perſpirable Matter, or that rare, ſubtile fluid which exhales from the whole ſurface of the body, and from the ſurface of cavities, is evacuated from the extremities of ſubcutaneous arteries. *Sweat* is nothing elſe than perſpirable matter collected and condenſed into viſible drops on the ſurface of the ſkin, and mixed with the matter of the cutaneous glands. Sweat and Perſpirable Matter then have the ſame common origin, and the ſame cauſes that augment the excretion of the one, augment alſo that of the other. Sweat is always viſible and fluid like water; but the matter of perſpiration is in a ſtate of vapour, and when it is diſcernable, it appears like a cloud that envelopes the body from which it comes *(Halleri Pr. Lin. Phyſ.* § 434.*)*. Perſpiration is natural and inſeparable from good health. Sweat is unnatural, and always the concomitant of diſeaſe, as Hippocrates himſelf knew.

Notwithſtanding Hippocrates averred that the whole body exhales and inhales, yet Sanctorius, an Italian, not more than a century ago, was the firſt who attended particularly to the function of perſpiration, and the cauſes which affect it. He ſays that—" If in one day, eight pounds of meat and drink be taken in, the quantity of perſpirable matter evacuated in the ſame time is equal to five pounds *(Sect.* I. *Aph.* VI.*)*:" hence it is plain that—" The evacuation by perſpiration greatly exceeds thoſe of *foeces* and urine *(Sect.* I. *Aph.* IV.*)*," being to them both as five is to three. Dodart, a Pariſian, ſays the quantity of matter perſpired is to that evacuated by the *rectum* and bladder not more than as fifteen is to twelve, or as fifteen is to ten. But neither Sanctorius nor Dodart have left us any deſcription of their experiments, and we cannot

The *Veins* empty their blood into thoſe under the ſkin.

The

but ſuſpect their accuracy. Sanctorius has only given us a few Aphoriſms, in a book intitled *Medicina Statica*; and Dodart only a ſew corollaries.

De Gorter in France *(Comment. in Aph. Sanct.)*, Keil in England *(Med. Stat. Brit.)*, Robinſon in Ireland (On Food and Diſcharges), Linings in South Carolina; Home in Scotland (Medical Facts), and Blumenbach in Germany, have, each of them, made experiments; from which it appears, that they differ not only from Sanctorius, but from one another.

Some, among whom is Haller *(Pr. Lin. Phyſ* § 438.), cenſure Sanctorius for making no mention of the ſpittle, and the *mucus* of the noſe, &c. but it can ſcarcely be imagined that the accurate Sanctorius neglected theſe.

Dr. Cullen ſays there is a certain balance between the force of the heart and the reſiſtance of the extreme veſſels, by which perſpiration is performed. He affirms the reſiſtence of the latter to be oftentimes ſo great as to diminiſh the perſpiration (Treatiſe on the Materia Medica, Vol. I. p. 82.).

The variation then in the quantity of matter evacuted by perſpiration depends upon the difference of conſtitution, age, country, ſeaſon, prevailing diſeaſe, diet, ſleep, exerciſe, &c. *(Sanct. Sect.* I. *Aph.* 7. *Keil Aph.* 6.).

Perſpiration, generally ſpeaking, is encreaſed by whatſoever excites an inordinate action of the ſubcutaneous arteries, or induces an unuſual laxity of the ſkin. Of this kind are Heat, Friction and Motion, certain Affections of the mind, a dry Atmoſphere, Electricity, &c.

Perſpiration is diminiſhed by Cold, Fatigue, Sleep, Old Age, a moiſt Atmoſphere, certain Conditions of the Stomach, and the augmentation of any excretion. But there is a certain *punctum ſudorificum*, above or below which we do not perſpire (Alexander's Experimental Eſſay, p. 161.).

Theſe cauſes being conſidered, we need not wonder that different perſons, of different conſtitutions, and ages, living in different climates, uſing different exerciſes, and feeding on different kinds of food, ſhould have found the quantity of perſpired matter various.

The *Nerves* of the ſkin, which are very numerous, are divided into extremely ſmall filaments,

The chief of the known uſes of perſpiration are, to rid the blood of a thin aqueous matter, and to keep the heat of the body within proper bounds.

A ſuppreſſion of perſpiration, continued for a certain time, ſeems to be productive of no inconvenience. For in ſome parts of the world, people anoint themſelves with oil, and thus ſtop up the mouths of the exhaling arteries; and Dr. Home ſuppreſſed his own perſpiration, without ſuſtaining any harm (Medical Facts, Exp. 17.).

Of Sweat, it is ſaid by Boerhaave, that when it is in large quantity there is leſs matter evacuated by perſpiration (*Inſt. Med.* § 432.); but this is a miſtake, for the ſame veſſels that pour out perſpirable matter, pour out ſweat likewiſe.

Perſpirable matter may be condenſed and collected by breathing on glaſs (*Boerh. Pr. Acad. Vol.* 3. *p.* 577.); by ſurrounding the body with cloth dipped in oil (*Tachenius de Morb. Princ. p.* 153.), &c.

It belongs to this place to remark, that ſome phyſicians have an idea that the animal body has a power of generating cold (Phil. Tranſ. Vol. 65.). This was originally announced by Dr. Cullen of Edinburgh, and has ſince been confirmed by the experiments of Dr. Fordyce, Dr. Charles Blagden, and others, who remained ſome time in the air of a room which raiſed the mercury above 212° of Farenheit's ſcale, without ſuffering any injury; and what is more, without having the heat of their bodies much encreaſed by it.

In theſe ſame experiments, it is alſo proved, that an animal body can produce cold, whether it be in a dry or a moiſt atmoſphere. So that the philoſophers who conceived that the evaporation on the ſurface of the body is enough to explain the phenomenon, without recurring to a law which probably does not exiſt (See a paper, in the Mem. of the Lit. and Phil. Soc. of Mancheſter, by George Bell, M. D.), may conſult with advantage the Exp. and Obſ. of Dr. A. Crawford, in which the ſubject of animal heat is fully and clearly diſcuſſed.

But I have ſaid that, one uſe of perſpiration is to preſerve the heat of the body within due bounds; and I

think,

filaments, and ſerve for the ſenſe of touch, over the whole body, eſpecially at the tops of the fingers.

The *Uſe of the ſkin* is to cover and defend the body; to ſupport the exhalent and abſorbent veſſels; and to form the organ of touch (356).

Adipoſe Membrane is compoſed of the cellular texture lying upon the muſcles under

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think, this uſe can hardly be doubted. For there is no reaſon that animate matter moiſtened, ſhould not produce cold, as much as inanimate matter moiſtened; and therefore, though it be granted that animals do really poſſeſs an occult power of generating cold, independent of evaporation; yet, that the heat of their bodies is moderated by evaporation alſo, ſeems indiſputable.

There is certainly nothing derogatory to ſound philoſophy in this; no more cauſes are aſſigned than are neceſſary to explain the phoenomena.

The vapour exhaled from the lungs, mouth, noſtrils, *fauces*, &c. differs from that of moſt parts of the ſurface of the body chiefly in not being mixed with the ſebaceous matter of the ſkin, and the liquor effuſed into cavities, which is collected there in large quantity, and reabſorbed, ſhould not be confounded with the matter that paſſes off in evaporation from the external ſurface of the body.

(356) *Touch* is a ſenſe different from all others; in ſo far as, by it we perceive not one quality only, but many, and thoſe very different: as heat and cold, hardneſs and ſoftneſs, roughneſs and ſmoothneſs, figure, ſolidity, motion, and extenſion (Reid's Inquiry into the Human Mind. Chap. V. Sect. I. p. 99.): Therefore, we are taught by experience, that the organ of touch is nearly every part of the body.

But *Touch* is a word commonly taken in a more limited ſenſe; it ſignifies that ſenſation which is excited in the mind by external bodies affecting the ſkin, eſpecially the tips of the fingers, where tangible qualities are by far moſt accurately diſtinguiſhed (Haller, *Primae Lineae*, § 421.).

the ſkin, which is formed of very ſmall elaſtic, inſenſible veſicles or follicles, opening into one another, and in moſt parts, containing fat (357).

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(357) The cellular membrane, or *tela celluloſa* of Haller *(Primae Lin. Phyſ.)*, was almoſt generally believed, previous to Dr. W. Hunter, to be the inorganic baſis of all our organized and vaſcular ſolids. But Dr. Hunter was inclined to believe that every viſible part of our body is vaſcular, and that the inorganic *ſtamina* are too minute to be ſeen.

Dr. Hunter ſays that the cellular membrane is of two kinds, reticular and adipoſe. The reticular membrane is evidently diſperſed throughout the whole body, except perhaps the ſubſtance of the bones, of the brain, and of the humours of the eye. It makes a bed for the other ſolids of the body, it covers them all, and unites them to one another. It pervades the *adeps* or fat, and unites all its *moleculae* together.

Parts have a freer motion upon one another in proportion as the quantity of cellular membrane is greater, and its ſubſtance more rare and delicate in texture. But where the greateſt freedom of motion is requiſite, nature has laid the parts together, and covered them with a ſmooth, thin, but compact membrane, ſtretched all around in form of a bag, by which means the lubricating fluid is confined in its proper place. Such is perhaps the theory of the *pleura*, *pericardium*, *peritonaeum*, *tunica teſtis*, the capſular ligaments of the joints, and the bags placed about tendons and ligaments, particularly where they move upon bone.

Cellular membrane differs in different parts of the body, and at different times of life, in different conſtitutions, and under different circumſtances of health. If the cellular membrane had been adipoſe in the eye-lids, fat people muſt have been blind; and if in the ſubſtance of the lungs they muſt have been ſuffocated. About the joints the cellular membrane is chiefly reticular, for the ſake of eaſy motion; but under the ſkin it is generally adipoſe.

In *foetuſſes*, that part only of the cellular membrane is adipoſe, which is upon the outſide of the body. As we

The *External Surface* of the adipoſe membrane is unequal; becauſe of many eminences, which form depreſſions in the ſkin and are united to it. Its *Internal ſurface* fills up the interſtices of muſcles.

Its *Uſes* are, to ſecure the internal parts from cold; to preſerve the free motion of the ſkin upon the muſcles; and to encreaſe the whiteneſs and beauty of the body.

grow up the fat is more equally diſperſed through the body, and in greater quantity, in proportion about the *viſcera*.

That the oil of the cellular membrane is lodged in the ſame cavities as the watery fluid in *anaſarca*, was a common opinion. But Mr. Hunter apprehends that there is a particular organization or glandular *apparatus* ſuperadded to the reticular membrane, conſiſting of veſicles or bags for lodging the animal oil, as well as veſſels fit for its ſecretion; ſo that he compares the marrow in bones to the glandular and follicular parts of the fat or adipoſe membrane, and the net-work of bony fibres and *laminae*, which ſupports the marrow, to the reticular membrane, which is mixed with and ſupports the *adeps*.

This opinion of the *adeps*, and adipoſe membrane, was inferred by Dr. Hunter from the granulated appearance of marrow, from ſome parts of the reticular membrane never becoming fat, in the fatteſt bodies; from water in *anaſarca*, and air in *emphyſema*, occupying thoſe parts moſtly which are freeſt from fat, as the eye-lids, *ſcrotum*, &c. from the appearance of both ſpecies of cellular membrane in perſons that have died of dropſy, in whom the oil of the habit is exhauſted; the adipoſe membrane, when free from fat, appearing more fleſhy and ligamentous than the reticular; from water and blood paſſing freely, and even by their own gravity, from one part of the reticular membrane to another, whilſt fat in the fatteſt perſons never paſſes by the ſame way; and laſtly, from the water in *anaſarca*, and the air in *emphyſema*, or from oil injected into the reticular membrane, returning again into parts from whence it was preſſed, while the oil of the adipoſe membrane cannot be made to recede by any preſſure (Med. Obſ. and Inq. Vol. II. p. 26.).

The *Nails* are thin, horny, inſenſible *laminae*, more or leſs rigid, placed at the extremities of the fingers and toes.

Their *Fabric* is made up of the condenſed Malphigian mucus of the Epidermis.

They ariſe, by a quadrangular beginning, from the laſt phalanx of the fingers, between a ſemilunar folding of the *epidermis*, and are covered by it, internally and externally, even to their anterior extremities (353). The Nails are divided into

1. The Root, in which we may obſerve a white ſpot, of the form of a creſcent.

2. The Body, which is the middle part, and

3. The Anterior, Sharp edge.

The *Uſe of the nails* is, to defend the nervous *papillae* which are under them, and to preſs the tops of our fingers more cloſely to a body, when we touch it.

There can be no doubt, but that we may uſe them for defence.

The *Hairs* are ſmall, cylindric, diaphanous, inſenſible and elaſtic filaments, which ariſe from the ſkin, and are faſtened in it, by means of ſmall roots.

As to their *Fabric*, they conſiſt of a ſpongy, cellular texture, containing a coloured liquid, and a proper covering.

The *Color of the Hair* depends upon the liquor contained in the cellular texture.

Hair is of two kinds *Long Hair* ariſes on the ſcalp, the cheeks, the chin, the breaſt of men, the anterior part of the arms and legs, the *axillae*, the groins, and the pubis. *Short Hair*, which is the ſofter of the two, is preſent over the whole body, except only the palm of the hands and the ſole of the feet. The hair originates, in the adipoſe membrane, from an oblong membranous bulb, which has veſſels peculiar to it. This bulb encloſes another, which is moiſtened with blood, and is the true ſeat of the hair.

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(353) Thoſe who are deſirous to learn the hiſtory of the nails, their origin, &c. may conſult Marherr's *Praelectiones in H. Boerh. Inſt.* § 432.

The Hair, defended by the covering derived from the bulb, paſſes through the ſkin to the *epidermis*, which it elevates and carries with it like a ſheath. The cellular ſpongy texture, included in the membranes now mentioned, extends even to the extremities of the hairs. The hair grows continually, and is renewed, if cut off; for the *medulla*, which it contains, is protruded towards its ends, and thus the *epidermis* is elongated. But in old people, when the hair is deprived of this *medulla*, it becomes dry, ſplits, and falls off. Laſtly, the hair is diſtinguiſhed by particular names, according to its various ſituations, which ſhall be taken notice of in its proper place (359).

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(359) The Hair of the head, and of the eye-brows and eye-lids grows even in the *uterus*, and has been called, for that reaſon, *Pili Congeniti*, in contradiſtinction to that which grows out, in the courſe of time, over the whole body, and is called *Pili Poſtgeniti*.

Some people diſtinguiſh the hair by different names, according to the part in which it grows: hence, on the top of the head, it is called *Capillus*; on the back of the

Concerning the uſe of the hair, nothing determinate can be ſaid of it, with reſpect to the body.

Some have aſſerted that its points, if not its entire ſurface, exhales a certain moiſture. Indeed, the hair of the head conciliates much to warmth and beauty. The Eye-brows and Eye-lids defend the eyes from ſweat and inſects; and in other parts, hair ſerves to prevent the effects of friction, &c.

The Cavity of the Abdomen.

This great cavity is bounded ſuperiorly by the diaphragm, inferiorly by the *oſſa pubis* and *iſchium*; on each ſide by various muſcles, the ſhort ribs, and *oſſa ilii*; anteriorly by the abdominal muſcles; poſteriorly by the *vertebrae* of the loins, the *os ſacrum* and *os coccygis*. Internally, it is inveſted by the *peritoneum*, externally by muſcles and common integuments.

In the cavity of the abdomen are contained

1. *Anteriorly* and *Laterally*,
    1. The Meſentery,
    2. The Epiploon,
    3. The Stomach,
    4. The Large and Small Inteſtines,

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head, *Crinis*; on the temples, *Cincinnus*; on the eye-lids, *Cilium*; on the eye-brows, *Supercilium*; in the noſtrils, *Vibriſſa*; on the chin, *Barba* (or, when it firſt appears, *Lanugo)*; in the middle of the chin, *Pappus*; immediately under the noſe, on each ſide of the upper lip, *Myſtaces*.

Hair on the body is called *Pilus*.

5. The Lacteal Veſſels,
6. The Pancreas,
7. The Spleen,
8. The Liver and Gall-bladder,

2. *Poſteriorly, without the Peritoneum*, are
   1. The Kidneys,
   2. The Supra Renal Glands,
   3. The Ureters,
   4. *Receptaculum Chyli*,
   5. The Deſcending Aorta,
   6. The Aſcending Vena Cava.

3. *Inferiorly in the Pelvis*, and *without the Peritoneum*,

In Men, are
1. The Urinary Bladder,
2. The Spermatic Veſſels,
3. The *Inteſtinum Rectum*.

In Women, beſide the Urinary Bladder and *Inteſtinum Rectum*, there are
1. The *Uterus*,
2. The Four Ligaments of the *Uterus*,
3. The Two Fallopian Tubes,
4. The Two *Ovaria*,
5. The *Vagina*.

Hitherto we have given the Diviſion of the Abdomen into various regions.

The Peritoneum.

The *Peritonaeum* is a firm, but ſimple membrane, the internal ſurface of which is ſmooth and moiſt, and the external ſurface covered with cellular membrane and fat. This membrane covers the whole inferior ſurface of the diaphragm, then deſcends forwards, behind the abdominal muſcles, into the *pelvis*, and extends over the urinary bladder, and, in women, over the *uterus*; it is connected, by one part, to the *inteſtinum rectum*. Poſteriorly, it deſcends over the lumbar region into the *pelvis*, and is there extended over the *inteſtinum rectum*; ſo that it involves all the *viſcera* of the abdomen.

Every thing ſituated within this ſack, ſuch as the Stomach, the Spleen, the Liver, the *Omentum magnum* and *parvum*, the Pancreas, the Small and Large Inteſtines, and the Meſentery and Meſocolon, are ſaid to be contained in the *peritonaeum*: but thoſe which are not involved in that ſack, are ſaid to be without the *peritoneum*: ſuch are the Kidneys, the Urinary Bladder, the *Uterus*, the Spermatic Glands, the larger blood-veſſels, &c. But if any one be deſirous to ſpeak properly, he may ſay that all the abdominal viſcera are without the peritoneum, ſince they all take the external coat from it.

The cellular texture of the external ſurface of the *peritoneum*, is in many places filled with much fat; in other places it forms various productions, the chief of which go out, on both ſides, through the abdominal rings, covering the ſpermatic cord and *teſtes*. Some productions of *peritoneum* incloſe the iliac veſſels, the *inteſtinum rectum*, the *penis*, the crural veſſels, &c. and others penetrate the diaphragm, and paſs into the thorax, with the *aorta* and *oeſophagus*, where they join the *pleura*. Hence it is that we oftentimes ſee the greateſt communication of the *peritoneum* with the whole body, eſpecially in thoſe who labour under dropſy.

Beſides, there are ſhorter productions of *peritoneum*, in different places, called *Ligaments*. Theſe ligaments are formed of a duplicature of *peritoneum*; for while the *peritoneum* recedes from the internal ſurface, it incloſes cellular membrane in the middle, and goes to ſome *viſcus*. When it is come to any *viſcus*, the *laminae* of *peritoneum* are ſeparate from each other, and they receive the *viſcus* between them. The cellular membrane, which was upon the ſurface before, is now alſo within the duplicature, uniting the *peritoneum* and the external ſurface of the *viſcus* together. To this kind may be referred, the Meſentery, the four Ligaments of the Liver, the one, or two ligaments of the Spleen, and thoſe of the *Inteſtinum Colon*, the Kidneys, the *Uterus* and *Vagina*.

The *Veſſels* of the Peritoneum come anteriorly from the mammary epigaſtric, and diaphragmatic artery; laterally from the lumbar, coſtal, renal and iliac arteries; poſteriorly from the arteries of the diaphragm, the liver, the ſpleen, the ſtomach, the kidneys, the meſentery, and the ſpermatic, lumbar, intercoſtal, and hypogaſtric arteries; alſo from the internal arteries of the *inteſtinum rectum*.

The *Veins*, diſtinguiſhed like the arteries, go all of them to the *vena cava.*

The *Uſe* of the *Peritoneum* is

1. To retain the abdominal *viſcera* in their right place.
2. To hinder the *viſcera* from growing together, by exhaling a liquor.
3. To ſurround all the *viſcera* by its internal productions, and to form various ligaments.

The Meſentery.

The *Meſentery*, as already obſerved, is a production of *peritoneum*: ſo that it conſiſts of two *laminae* with intermediate cellular membrane. It begins by a narrow beginning at the firſt, ſecond, and third *vertebra* of the loins; paſſes forwards, grows wider and wider in its courſe, and at length incloſes within its *laminae* the whole *inteſtinum jejunum*, *ileon*, *colon*, and the ſuperior part of the *rectum* (360). The *Meſentery*, ſtrictly ſpeaking, is only that which adheres to the ſmall inteſtines; for when connected with the large inteſtines, it is called *Meſocolon* (361). Both that and this contains within its *laminae* much fat, numerous glands, and very many nerves from the meſenteric plexus.

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(360) The Meſentery, which is the largeſt production of the *peritoneum*, does not cover the whole *duodenum*, but only its end, or left extremity.

(361) In general, the *peritoneum*, inveloping the large inteſtines, is called *Meſocolon*; but in the hollow of the *ſacrum*, inveloping the *rectum*, Haller uſed to call it *Meſocolon inferior*, and Hunter and others *Meſ. rectum.*

The Meſenteric Arteries, all of them, come from the *aorta*: the *Veins* terminate in the *vena portae* (362).

Beſides, the meſentery has lacteal and lymphatic veſſels running through it to the thoracic duct.

The *Uſe* of each meſentery is

1. To keep the inteſtines ſteady.

2. To afford an external coat for the inteſtines, and

3. To ſuſtain lacteal, lymphatic, and ſanguiferous veſſels.

The Omentum.

The *Omentum*, or *Epiploon* is a membrane ſomewhat like the *peritoneum*; it is thin and eaſily torn; it covers the inteſtines anteriorly, *behind the peritoneum.*

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(362) As ſoon as the lacteals of the meſentery are come out of the glands (ſee the Adenology), they form a large trunk, which accompanies the trunk of the ſuperior meſenteric artery, till it arrives at the right ſide of the *aorta*, near its origin; whence it paſſes ſometimes almoſt immediately into the thoracic duct. Mr. Cruikſhank has known it more frequently inſerted lower than this place, and that having left the ſuperior meſenteric artery, and run down on the right ſide of the *aorta*, it came to the place where the two trunks of the lower extremities entered the duct, where it alſo aſſiſted to form the thoracic duct (p. 162.).

It conſiſts of two *laminae*, connected together cloſely by very fine cellular membrane, and including fat ſecreted there by veſſels (363). It alſo ariſes from the *peritoneum*, and is ſubdivided into the *Great Omentum* and the *Little Omentum*; both of which are joined together, and are of the ſame fabric.

The *Great Omentum*, or *Gaſtrocolicum* ariſes from the whole of the larger arch of the ſtomach even as far as to the ſpleen, from whence it deſcends looſely behind the abdominal muſcles and over the inteſtines to the navel, and ſometimes into the *pelvis*: Having deſcended thus far, its inferior margin turns inwards and aſcends again and is faſtened to the external coat of the *Colon*, and the Spleen, where its veſſels enter. Laſtly, it ends in the *Oeſophagus* under the diaphragm.

Moreover, the *Colon* has alſo an *Omentum* placed rather on the right, joined to the *Omentum magnum*, and bearing the name of *Omentum colicum*. It ariſes from the external, double coat of the *Colon*, which divides, projects forwards, and is connected by its cuneiform *Apex* to the *Caecum*.

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(363) Perhaps Leber alludes by the words "*per vaſa ſecretam*," (i. e. *pinguedinem*,) to the *Adipoſe Ducts* of Malpighi. Morgagni conſiders ſuch ducts unneceſſary, and thinks that fat is every where ſecreted by arteries (*Adverſ. Anat.* III.). Rivinus and Heiſter think the ſame, and ſo do I. But, to do juſtice to Malpighi; he himſelf, in the latter part of his life, doubted the exiſtence of adipoſe ducts.

In a young *foetus*, the *omentum* contains no fat (Haller, *El. Phyſ. T.* I.) though itſelf be always preſent (Roſslein, Lip. Com. Vol. 29.); but in old people, how emaciated ſoever, it is plentifully larded.

The SMALL OMENTUM, or *Hepaticogaſtricum*, ariſes poſteriorly from the tranſverſe fiſſure of the Liver. It is compoſed of the conjunct coats of the *peritoneum*, which deſcend here; it then paſſes over the *Duodenum* and the ſmall lobe of the Liver; it paſſes by the *Lobulus Spigelii* and the Pancreas, goes into the *Colon*, and emerges at the inferior orifice of the ſtomach and its ſmall curvature. Then becoming harder, and leſs fat, it is implanted ligamentous into the *Oeſophagus*, and connects it with the diaphragm.

We may obſerve in this *Omentum* the natural aperture, which was firſt diſcovered by Winſlow (364). The cavity of the *Omentum* and all its ſacs may be diſtended by air forced through this aperture. The ſituation of this aperture is always behind the *Lobulus Spigelii*, between the right ſide of the Liver and the hepatic veſſels, the *Vena Portarum*, and the contiguous *Duodenum*, behind the membranous production, from which the little *Omentum* ariſes.

The *Nerves of the Omentum* are very ſmall, ariſing from the eighth pair.

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(364) This opening (Winſlow, *Expoſ. Anat. T.* 2. *Sect.* VIII. § 15. 361.) ſays Heiſter, I could not always diſcover; therefore, I ſuſpect that, it is not always preſent (*Comp. Anat. Nota* 7.).

The *Arteries of the great Omentum* come from the ſtomach. They are two in number, the *right* and *left*. The *Omentum colicum* has its arteries from the colic, the right epiploic and the duodenal.

The large *Veins of the Omentum* go to the *Vena Portarum* and to the trunks of the ſplenic and meſenteric veins; the ſmall veins run along with the arteries of the ſame name.

Modern Anatomiſts have detected *Lymphatic Veſſels* in the *Omentum* (365).

The *Uſes* of the *Omentum* are various, viz.

1. By its oleaginous exhalation, it lubricates the inteſtines, the liver, the ſpleen, and the ſtomach, leſt by their motion over one another, and againſt the *peritoneum*, they ſhould be hurt (366).

2. It ſerves for the ſecretion of fat; which fat is carried to the liver by abſorbent veſſels,

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(365) The Abſorbents of the *omentum* have the ſame names as the arteries. They enter glands between the ſuperior edge of the *omentum*, and the inferior edge of the ſtomach; and after paſſing out of theſe glands they blend with the abſorbents of the ſtomach. Cruikſhank ſays theſe glands are not always found, and when they are found, are commonly very ſmall (p. 178.).

(366) It has already been ſhown that oil never exhales from the adipoſe membrane (See Notes 140. 142. and 357.).

to conſtitute the moſt powerful part of the bile (367).

3. It ſerves to cheriſh the ſtomach and inteſtines, and to favour digeſtion (368).

4. Many diſeaſes ſeem to prove, that liquids exhaled from the *omentum*, and from the meſentery, into the cavity of the abdomen, are abſorbed; for they often become dropſical, in whom theſe *viſcera* are obſtructed, or otherwiſe diſeaſed (369).

Of the Stomach.

The Stomach is a membranous bag, reſembling a bag-pipe, placed under the diaphragm, in the middle of the epigaſtric region, and partly alſo in the left hypochondriac region behind the liver, and the left ſpurious ribs: it is deſtined to receive the food.

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(367) Blumenbach will not allow this uſe of the *Omentum*: he is perſuaded that the Bile does not contain oil; and he could not diſcover the pores which Malpighi ſuppoſed were deſtined for the abſorption of fat in frogs, and much leſs in man (*Inſt. Phyſ.* § 407.). He believes, however, that fat exhales from the *Omentum*, and ſuppoſes its uſe to conſiſt in its lubricating the inteſtines, and rendering their motion over one another eaſy (See Note 466.).

(368) I think this uſe is very obvious, becauſe all animals with membranaceous ſtomachs have an *Omentum*, and becauſe of the obſervation in (Note 369.).

(369) There is nothing in this uſe that I can find: for dropſy may ariſe in conſequence of a diſeaſe of other parts within the abdomen, as well as of the *Omentum*. Chauſſier denies that the *Omentum* has any ſuch uſes as thoſe mentioned in the text. He believes its uſe to be to permit the ſtomach to be diſtended by aliments, and to aſſiſt its diſtention. This uſe ſeems to me as likely as any; for as the external *Laminæ* conſtituting the *Omentum*, divide where it ariſes at the ſtomach, ſo when the ſtomach is full, the *Omentum* is contracted, and when it is empty, the *Omentum* deſcends (*Nouveaux Mem. de l'Acad. de Dijon*, 1784. 1785.).

The *Figure* of the ſtomach is ſomewhat oblong and round: it is larger on the left ſide, near the *oeſophagus*; but on the right ſide, at the inferior orifice of the ſtomach it is gradually leſſened.

It is *connected* by its orifices, above with the *oeſophagus*, and below with the *duodenum*: it is connected to the ſpleen on the left ſide, by means of a large part of the *omentum* and the *vaſa brevia*; anteriorly, and poſteriorly, it is joined to both *omenta*.

We obſerve in the ſtomach,

Two *Orifices*,

Two *Surfaces*,

Two *Arches*, or *Curvatures*,

Four *Coats*, together with numerous *glands*, *arteries*, *veins*, *nerves*, and *lymphatics*.

Of the Two Orifices of the Stomach.

1. The *Left*, or *Superior*, is ſituated in the epigaſtric region, towards the left *hypochondrium*, and rather poſteriorly: it conſtitutes the end of the *oeſophagus*.

2. The *Right* or *Inferior* is alſo in the epigaſtric region, but towards the left *hypochondrium*, and turned rather forwards. At its extremity, where the *duodenum* begins, there

is a large fold, like a thick, ſmooth, ring; this fold is compoſed of tranſverſe muſcular fibres, cellular membrane, and the nervous and villous coats of the ſtomach: it is inveloped by the *duodenum.*

The middle part of the ſtomach is moſtly placed under the enſiform cartilage (370).

The *Surfaces* of the Stomach are

1. The *Anterior*, turned towards the abdominal muſcles.

2. The *Poſterior,* oppoſite the lumbar *vertebrae.*

Its *Arches*, or *Curvatures* are

1. The *Large Arch*, to which the large *omentum* adheres: it is placed forwards, but rather downwards, and is extended from the one orifice to the other.

2. The *Small Arch*, which is alſo between both orifices, but ſuperiorly and poſteriorly. The little *omentum* is inſerted into it.

Its *Coats* are the following,

1. The *Outermoſt*, which is very firm, being continued from the *peritoneum:* it ſurrounds the other coats. Both *Omenta* come from this coat, and the ſtrength of the fleſhy

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(370) The ſituation of the ſtomach, in a living body, is not always the ſame. When it is full of either meat, or drink, it aſcends and advances forwards; conſequently it draws up the *pylorus* and *duodenum* with it. When it is empty, it is nearly vertical from the *oeſophagus.*—In a dead body, the ſituation of the ſtomach is far otherwiſe; its large arch is the inferior of the two, being turned towards the *pelvis*, but the ſmall arch is the ſuperior, &c.

fibres of the ſtomach placed under it, is encreaſed by it.

2. The *Muſcular* is the next coat of the ſtomach, ſo called, becauſe it is compoſed of various muſcular fibres. The longitudinal fibres of the oeſophagus extended as far as the ſtomach, are diſſeminated through it in different directions: ſome run through the ſmall arch to the right orifice of the ſtomach, and from this to the *duodenum*, where they are gradually loſt. Very many of theſe muſcular fibres are diſtributed, in this courſe, on both ſurfaces of the ſtomach: ſome diſappear on the left ſide; and ſome, ariſen from the circular fibres of the *oeſophagus*, ſurround this bag, and the ſtomach, even to its inferior orifice, together with the circular fibres of the ſtomach itſelf. Laſtly, there are other longitudinal fibres paſſing between both arches of the ſtomach, and going to the inferior orifice: they tighten this orifice, and they are called *Ligamenta orificii ventriculi inferioris*. Between this coat and the former, there is cellular membrane (371).

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(371) It is ſomewhat ſingular that although the muſcular fabric of the ſecond coat of the ſtomach have always been allowed, it is ſo variouſly deſcribed by different anatomiſts. Boerhaave copied Willis (Haller's note 3. on Boerh. *Præl. Anat. in prop. inſt. med.* § 81.): who deſcribed ſpiral fibres, which are only to be found in brutes. Joan. Laurence Gaſſer was of opinion that if one were to examine a hundred human ſtomachs, he would not find two among the whole alike (Marherr *in Boerh. Inſt. Med.* § 81.):

3. The third Coat is called *Nervous*. It is whitiſh, firm, thick, and conſtitutes the genuine fabric of the ſtomach. Between it and the former, there is cellular membrane.

4. The Fourth, or Inmoſt Coat is called *Villous*: this is ſingle, very red, covered with mucus, and conſiſting of ſhort, prominent *villi*, and large folds. It ariſes, as already

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§ 81.): but Haller declares that the muſcular coat of the text is more conſtantly obſerved, eſpecially in robuſt ſubjects; i. e. formed of two orders of fibres, the one external and *longitudinal*, the other internal and *circular*.

Now a circular fibre there is not in the whole animal body: for thoſe muſcles called *Sphincters* are not compoſed of circular fibres, but of the arcs of circles, decuſſating one another at their ends, and ſo forming entire circles.

The ſtomach begins to contract at the left orifice, whilſt every part betwixt it and the right orifice is quiet; for the motion of the ſtomach is regular and circular (Hunter's Obſ. on Digeſtion, p. 159.); beginning from the part moſt irritated (Haller *Pr. Lin.* § 650.); ſo that the parts on the right of the left orifice are contracted in order; and laſt of all the *pylorus*: and in the inteſtines, and in the *oeſophagus*, the inferior parts relax progreſſively as the ſuperior contract. In the ſtomach this motion is called *Vermicular*: in the inteſtines it is alſo called *Vermicular*, or *Periſtaltic*. When the contents of the ſtomach have paſſed the *pylorus*, the motion of the ſtomach begins again (Wepfer. *L. c. p.* 117.).

The ſtrength of the muſcular fibres of the ſtomach is very great. Haller aſſerts that the cavity of the ſtomach may be obliterated, even in a natural ſtate, by the contraction of its muſcular coat (*El. Phyſ. Tom.* VI. *p.* 263.), but Boerhaave aſſerted the contrary (*Prael. Acad.* § 83.). It is hard to decide; but it is certain that the contraction of the fibres of the ſtomach is far greater than John Bernoulli and his Son Daniel, or any other mathematician had accounted it.

mentioned, from the *epidermis:* hence it may be renewed when deſtroyed like it.

Villi are ſmall veſſels, which either ſeparate or abſorb a determinate liquor (371). There is alſo cellular texture between this and the nervous coat, through which are diſperſed ſmall veſſels, penetrating the villous coat.

The *Glands* of the ſtomach are ſimple: they are diſtributed throughout the third cellular membrane, and they perforate the villous coat by their excretory ducts. They are more numerous about the right orifice of the ſtomach than other parts.

The *Arteries* of the Stomach come chiefly from the coeliac artery:

1. The *Superior* or *Left Coronary Artery*; a

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(371) Lieberkühn, ſpeaking of the *villi*, ſays that each of them conſiſts of a lacteal veſſel, a branch of the meſenteric artery and vein, and a ſmall nerve. The beginning of the lacteal veſſel, according to him, is an *Ampullula*, or Oval Veſicle, on the ſummit of each *villus*, conſiſting of a ſpongy, or cellular ſubſtance (*De Villis Inteſ.*). Hewſon would not aſſent to this imaginary *ampullula*; and the late Dr. Hunter, as Mr. Cruikſhank ſays (On the Abſorb. Syſt. p. 59.), ſaw fifteen or twenty orifices of lacteal veſſels on each *villus* of the *jejunum*, by means of a microſcope.

Mr. Cruikſhank obſerves, that the lacteals hang out from the ſurface of the inteſtinal canal in diſtinct packets, reſembling hairs, or the pile of velvet, from whence they have been called *villi* (page 56.).

[1] This note ſhould perhaps have been inſerted, when ſpeaking of the *villi* of the inteſtines; but I thought it more ſuitable here, where Leber ſeems to explain particularly what a *villus* is.

branch of which encircles the ſuperior orifice of the ſtomach; another branch runs along the ſmall arch, and is there joined to the ſmall right coronary artery, which is derived from the right branch of the coeliac artery.

2. The *Left Gaſtro-epiploic* artery ariſes from the ſplenic artery: it goes through the *omentum* to the ſtomach, and is diſtributed in branches over both its ſurfaces.

3. The *Right Coronary Artery* ariſes from the hepatic artery, runs to the left, over the ſmall arch of the ſtomach, and joins the large of the ſame name.

4. The *Right Gaſtro-epiploic Artery* ariſes from the hepatic artery, goes through the *omentum* to the ſtomach, and joins with its fellow of the ſame name.

5. The *Vaſa Brevia*, which come from the ſplenic artery, and run along the large arch of the ſtomach to the diaphragm.

6. The *Superior Artery of the Right orifice* comes from the hepatic artery: but

7. The *Inferior* arteries come from the gaſtro-epiploic.

The *Veins* accompany the arteries, have ſimilar names, and are, all of them, terminated in the *vena portae* (373).

It

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(373) The *ſuperior* gaſtric, or *coronary* vein, comes from the ſplenic branch of the *vena portarum*, and after accompanying the artery, is continued to the pyroric, and inſerted into the trunk of the *vena portarum*, which Haller, as well as Euſtachius, has obſerved (Haller, *Not. 16. in* § 77. *Præl. Acad. H. Boerh. in prop. Inſt. Rei Medicæ.*). The *Gaſtro-epiploica ſiniſtra* comes alſo

from

It is to be remembered, that theſe veins have no valves.

The *Nerves* of the Stomach are very numerous. They ariſe principally from the eighth pair. Some of its nerves come from the intercoſtal nerves: hence the greateſt ſenſibility belongs to the ſtomach, eſpecially to that part which is at the inſertion of the *oeſophagus* (374).

The *Lymphatic Veſſels* are diſtributed throughout the whole ſtomach; but they are moſt numerous in its ſmall arch. The celebrated Monro demonſtrated by artificial injections, that they all empty themſelves into the thoracic duct (375).

The

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from the ſplenic branch; as does the *Gaſtro-epiploica dextra*, &c.

(374) See the *Neurology*, in which the two *Stomachic Plexus*, which adhere to this part, are deſcribed, and from which the great ſenſibility of the *cardia* is deducible. —Boerhaave would not believe that the ſtomach needed ſo many nerves only for ſenſe and motion, but conceived that they impregnated the *ingeſta* with their proper liquor (Marherr, *Præl. in H. Boerh. Inſt. Med.* § 77.).

Haller ſays, that if the nerves of the eighth pair be tied, the power of the ſtomach, as well as the digeſtion of the aliment, is deſtroyed (*Pr. Lin. Phyſ.* § 630.). This, however, does not ſtrengthen the hypotheſis of Boerhaave.

(375) Cruikſhank makes a threefold diviſion of the lymphatics of the ſtomach. The *Coronaria Ventriculi*, which accompany the branches of the coronary artery and vein, from the anterior and poſterior ſurfaces of the ſtomach to four, five, or ſix glands, ſituated on the ſmall arch of the ſtomach, or between it and the little *omentum* of Winſlow. They are ſuperficially and deeply ſituated: they exceed the arteries and veins in number. Having paſſed

The *Uſe* of the Stomach is, to excite hunger, and partly thirſt, if the body needs it (376); to

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paſſed from the glands juſt mentioned, they paſs into the ſame glands behind the *duodenum* that the deeply ſeated lymphatics of the liver enter; and with theſe they go to the thoracic duct, on the right ſide of the *aorta*, near the coeliac artery. The *Gaſtrica Siniſtra*, which run with the left gaſtric artery upwards and to the left, and blending with the abſorbents of the ſpleen and pancreas, near the great end of the ſtomach, go together to the thoracic duct. This diviſion is joined by the *epiploica media* and *ſiniſtra* of the *omentum*. The laſt are the *Gaſtrica Dextra*: theſe ariſe about the middle of the large arch, and run along with the right gaſtric artery towards the *pylorus*, receiving in their courſe the abſorbents *epiploica dextra* of the *omentum*, and blending with the deeply ſeated abſorbents of the liver, behind the *duodenum*, run along with them to the ſame glands, and thence to the thoracic duct (p. 180.).

Cruikſhank could not diſcover chyle in the abſorbents of the ſtomach; though he ingeniouſly conjectures that ſome of the lacteals of the tranſverſe arch of the colon anaſtomoſing with the abſorbents of the ſtomach, chyle may paſs into the latter (p. 179.). Haller does not believe there are any chyliferous veſſels belonging to the ſtomach, as deſcribed by Biumi.

(376) We come now to treat of Digeſtion:—the term *Digeſtion* is here uſed to ſignify the converſion of aliment into a matter fit for the reparation of the loſs, which an animal body ſuſtains, and for the preſervation of the powers of life. Some call digeſtion *Concoction*, and ſome call it *Chylous Fermentation* (Marherr, *Prael. in H. Boerh. Inſt. Med.* § 76.). By others the term is uſed in a more unlimited ſenſe, to imply all the changes of the aliments as they occur ſucceſſively in the different ſtages through which they paſs: likewiſe it is ſometimes confined to ſignify the function of the ſtomach in changing the aliments (Cullen's Phyſ. Sect. IV. Cap. I.): but theſe definitions, which are founded on hypotheſes, are as fanciful as the hypotheſes themſelves.

Animals

to receive meat and drink brought into it by the *œſophagus*, and to retain them, till by the motion

Animals are inſtinctively led to chooſe and take in food, by the Appetites of *Hunger* and *Thirſt*.

The *Cauſe of Hunger* is not certainly known. We believe it to depend upon a peculiar ſtate of the ſtomach; but we know not what that ſtate is.——Do the gaſtric liquor, which diſſolves our food, when food is not preſent, act upon the ſtomach itſelf, ſo that the endeavour of the ſtomach to preſerve its own integrity, gives riſe to hunger? Whether it do, or not, it can ſcarcely be doubted that the ſooner aliment is digeſted, and expelled from the ſtomach, the ſooner we hunger after a freſh ſupply. Prof. Vachier, of Montpellier, ſays, that hunger is diminiſhed whenever there is too ſmall a quantity of the gaſtric liquors to excite in the nerves of the ſtomach that ſenſation which cauſes appetite (*Methode pour traiter toutes les Maladies, &c. p.* 15. *Tom.* II. *C.* 2.).

Now it is ſhown in another place, that the ſtomach is furniſhed with glands; the office of which is to diſcharge a *mucus* into its cavity. Is it not reaſonable then to believe that this *mucus*, being by nature interpoſed between the ſtomach and the gaſtric liquor, defends the ſtomach from the action of the gaſtric liquor? Nor can it be denied that gaſtric liquor, having had its more fluid part abſorbed, and being mixed with *ſaliva*, which in hungry perſons is always more acrid, and in greater quantity, diſſolves the *mucus* of the ſtomach, or hinders its ſecretion, and ſtimulates and corrodes the ſtomach itſelf. For if the *ſtimulus* be in any degree too ſtrong for the excitability, it firſt excites hunger, as hunger is generally felt, and ſhould food not be taken in, to abſorb the *ſtimulus*, to leſſen its activity, and to favour the function of the glands of the ſtomach, hunger ariſes, which is painful; and hunger may ariſe to cauſe fainting, madneſs, &c.

Do the ſtate, occaſioning the ſenſation of hunger, ever proceed from the mutual attrition of the folds of the ſtomach? Do it ever ariſe from the bile and pancreatic juice motion of the ſtomach, the admixture of various fluids, and many other changes, they are

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juice regurgitating thither? As the ſtomach contracts when empty, and falls into folds, the folds may rub one againſt another, and thereby abrade the natural *mucus*: and this will be greatly favoured by the concurrent periſtaltic motion, and the motion of the diaphragm and abdominal muſcles.

If Bile do get into the ſtomach, when empty, as Morgagni *Adv. Anat.* III. *Animad.* 24.), and Haller (§ 78. *Inſt. Med. Boerh.)* both aſſerted, being then very acrid, it may excite hunger.

Do the remains of aliment, in the folds of the ſtomach, become acrid, and excite hunger (§ 77. *Inſt. Med. Boerh.)?* The ſtomach is perhaps never empty *(Inſt. Med. Boerh.* § 88.).

As to ſatisfying the Appetite, Mr. Hunter holds, that the ſtomach is by inſtinct diſpoſed to receive food in proportion to its nouriſhment, and the powers of making chyle (Obſ. on the An. Oec. p. 178.).

It is hard to tell the *Cauſe of Thirſt*. Haller conſidering its ſeat in the tongue, *fauces*, *oeſophagus*, and ſtomach, parts by nature very irritable, and moiſtened with *mucus* and *ſaliva*, attributes it to a dryneſs of theſe parts; which dryneſs he thinks to originate in a defect of the uſually ſecreted fluids, depending upon a deficiency of aqueous matter in the blood, or the depoſition of muriatic and alkaline ſalts on the parts *(Pr. Lin.* § 639.). But, in conſidering the hypotheſis of Haller, it occurs, that if the blood in phlogiſtic *diatheſis* be thicker than in health, as Boerhaave and others taught, one might eaſily conceive that Thirſt is induced by ſuch thickneſs; becauſe thirſt always accompanies febrile and inflammatory diſeaſes; but Hewſon's experiments have been ſuppoſed to prove that blood, during fever and inflammation, is far thinner than in health.

Moreover water will not always quench thirſt: and it ſeems very likely, that acidulated liquors allay thirſt not ſo much by diſſolving and clearing away are rendered fit to paſs the right orifice of the ſtomach, and afford chyle in the inteſtines. Laſtly,

away *ſordes*, as by ſtimulating the parts, and exciting a new action in them.

Meat and Drink do not nouriſh immediately; for before they are adapted to this office, they undergo particular changes, and become chyle.

Meat and Drink, or *Aliment* which ſupports the body, and *Condiments*, which give a reliſh to aliment, or accelerate its digeſtion, are treated of in the *Materia Medica*, Vol. I.: we ſhall here only conſider digeſtion, and the changes which food undergoes, till its converſion into chyle.

The firſt change of our food, is the deſtruction of its coheſion and texture by chewing; for the action of the ſtomach does not in the leaſt contribute to the mechanical diviſion of aliment. During maſtication, the food is diluted with the liquors of the mouth, which flow into it, at this time, in large quantity: it is alſo mixed with a part of the atmoſphere.

This change is ſo neceſſary, that if ſome kinds of food be ſwallowed, not chewed, they are evacuated whole and undigeſted (Boerhaave, *Prael. Acad.* § 87.): hence the gizzard of ſome animals, and the grinding teeth of others, anſwer one common end. If the ſtone fruits *(Drupaceae)* which, when ripe, conſiſt of much pulp, incloſed in a ſtrong covering, be ſwallowed, the covering will be evacuated with the *foeces* unchanged. Oats frequently paſs unchanged through horſes.

The woody parts of vegetables, the huſks of fruits, are hard of digeſtion, are difficultly maſticated; they produce a large quantity of excrement (Hunter's Obſ. on Digeſtion, p. 179.). *Excrement* is food, or matter taken in with food, either totally indigeſtible, or nearly ſo.

The powers of digeſtion may often be known from the appearance of the *foeces*: (the *foeces* of the flea, however, are almoſt pure blood;) for if they be not much changed, the powers of digeſtion may be ſuppoſed to be weak, but

Laſtly, the ſtomach itſelf abſorbs part of a very ſubtle juice.

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not always, ſince food may be more or leſs ſuſceptible of alteration.

From all which it appears, and it muſt hereafter appear more clearly, that the larger the ſurface of digeſtible ſubſtances, the ſooner they are digeſted; but that when compact and of hard texture, even ſubſtances of a moſt nutritious kind are kept out of contact with the gaſtric liquor; and are of conſequence either evacuated unaltered, or elſe they ferment and putrefy. But the great utility of the gaſtric liquor being in contact with the food, is evident; ſince the digeſted ſurface muſt be a barrier to the action of the gaſtric liquor on the ſubſtance to be digeſted, beneath the ſurface: and the motion of the ſtomach, which is already deſcribed, ſeems to be one of Nature's means of clearing away the digeſted food, and of expoſing another ſurface to the gaſtric ſolvent. Stones, which are found in the gizzards of birds, ſeem to anſwer the ſame purpoſe; for they are not taken in by chance, as Spallanzani aſſerts (*Diſſ.* I. § 33. & *Diſſ.* II. § 60. &c.).

When food is properly chewed and ſwallowed, and conveyed into the ſtomach, if vegetable, it becomes as if boiled before it is digeſted: if animal, it is digeſted without any preparatory change; and when digeſted both of them form Chyle.

Now it is ſurprizing that the powers of digeſtion ſhould always make the ſame chyle, whether we live on animal or vegetable food.

But is chyle altogether formed in the ſtomach (Spallanzani's Diſſ. V. § 214.)? It is never white in the ſtomach, as chyle is in the inteſtines; nor is it of the ſame ſmell and colour; for it is a grey maſs till ſome time after it has been evacuated by the *pylorus* (Haller, Note 9. upon § 87, *Inſt. Med. Boerh.* alſo Cullen's Inſt. of Med. § 339.). This grey maſs is called *Chyme*; it conſiſts of what is received by the mouth, and more or leſs gaſtric liquor; for chyme coagulates milk and other ſubſtances, like the pure liquor of the ſtomach (Sennebier, *Exp. ſur la digeſtion, &c. p.* 89.). Nevertheleſs,

Mr.

Of the Inteſtines.

By the name of *Inteſtines* is underſtood, that long, cylindrical, membranous tube, variouſly

Mr. Hunter thinks that the ſtomach makes chyle, and that the *duodenum* is leſs fit for it (Obſ. on Digeſtion, p. 170.).

The ſeat of digeſtion therefore is perhaps the ſtomach and ſmall inteſtines; and chyle is unqueſtionably the only nutritive ſubſtance in nature.

But although ſubſtances are the ſooner digeſted, the more of them is expoſed to the ſolvent liquor, yet nature has given us few fluids as articles of diet, and even milk muſt be coagulated before it can be digeſted. Even in the youngeſt animals, coagulation happens almoſt inſtantaneouſly (Sennebier, p. 89.); ſo neceſſary is it to digeſtion.

Moreover, a certain degree of heat is neceſſary to digeſtion; but heat is a remote, and not the immediately efficacious cauſe of digeſtion. All animals digeſt more when warm than cold.

Agitation alſo aſſiſts digeſtion, for the ſame reaſon that it aids chemical ſolution; and finally, the functions and actions of the body regulate the proceſs of digeſtion, as with action there muſt be warmth, and with nutrition there muſt be action.

When living vegetables are ſwallowed, they are firſt killed, and afterwards digeſted; but before they are digeſted they become flabby.

When animals or vegetable ſubſtances are eaten alive, they are alſo robbed of the vital principle previous to their digeſtion (Hunter's Obſ. p 185.); afterwards they unite with the gaſtric liquor, loſe their texture, acquire a cineritious colour, and laſtly become chyle.

As to the objections of Dr Stevens to the parts of animals, endowed with the principle of life, having the ſame power as the intire animal, of reſiſting the action of riouſly inflected at the right orifice of the ſtomach, beginning at its extremity, and terminating at the anus.

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of the gaſtric liquor (*Diſſ. de Alimentor. Concoc. Edinb.* 1777. *p.* 58. *n.* x.), they need only be read to be condemned. For it is not proved by him that the ſtomach is ever digeſted while it is in poſſeſſion of the vital principle. After death, the greater extremity of the ſtomach is diſſolved, and afterwards, from contiguity, the ſpleen, diaphragm, and other adjacent parts (Hunter, on the Digeſtion of the Stomach after death.).

Theſe things being conſidered, it ſeems fit to conclude that Digeſtion differs from all other natural changes. It is not performed by heat alone, nor by triture, nor by fermentation, nor by putrefaction.

Sir John Pringle (Appendix containing exp. on ſeptic and antiſeptic ſubſtances) and Dr. Macbride (On the Fermentation of Alimentary Mixtures) were the chief who endeavoured to prove by experiment that digeſtion is merely and wholly a fermentation. Boerhaave was the chief who believed that only an incipient fermentation takes place (Inſt. Med.); and Cullen ſeems ſomewhat of his opinion, for he believes that the gaſtric liquor never acts on vegetables, unleſs they be at the ſame time undergoing a degree of fermentation (Mat. Med. Vol. I. p. 297.). Haller thinks Digeſtion is rather a putrefactive than an aceſſent proceſs (*El. Phyſ. T.* VI.).

To refute theſe hypotheſes it is not difficult. We are certain that no fermentation or putrefaction is neceſſary to digeſtion, and that when food undergoing any ſpontaneous change is taken into the ſtomach, its aceſcency or putridity is corrected. We know likewiſe that the digeſtion of our food begins and ends ſooner than any fermentation; and farther, that digeſtion is not accompanied with the ſame evolution of air, and the ſame inteſtine motion that characterizes every fermentative change.

That a fermentation however may happen, in the ſtomach, under certain conditions of it, is indubitable; but

The inteſtines are divided into *Small* and *Large.*

The

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but whether acid eructations, the expulſion of air, and a ſtinking breath are true ſigns of ſuch fermentation, it is uncertain. Perhaps the condition of the ſtomach, under which fermentation can happen, is when it ſecretes too ſmall a quantity of the gaſtric liquor, in proportion to the aliment taken in, or when it ſecretes a liquor of unuſual properties.

See the note on the Dorſal Gland of the *Oeſophagus* in the *Adenology.*

Monſ. Macquart has lately proved that there actually exiſts in the gaſtric liquor Phoſphoric Acid, completely formed (Roz. *Journ. ſur la Phyſique, &c.* 1788.); and the celebrated Macquier had long before aſſerted that the gaſtric liquor contains a latent acid *(Dic. de Chymie.).* Nevertheleſs, Spallanzani aſſerts that the acidity does not appear on all occaſions, and never after eating fleſh (Diſſ. VI. § 243.). Mr. Hunter again declares, that in moſt animals there is an acid, even though they ſhall have lived on meat for many weeks. And it is ſtill more favourable to the idea of Meſſ. Macquier and Macquart, that in the ſlink calf, near the full time of birth, before any thing can have been ſwallowed, or any diſeaſe have taken place, the contents of the ſtomach coagulate like thoſe of animals that have ſucked (Hunter, Obſ. p. 163.).

Conſult Dr. Young's Diſſertation on the power of coagulating ſubſtances in the ſtomach *(Diſſ. Med. de Natura et Uſu Lactis, &c.).*

The diſſolution of bone, in the ſtomach, can only be explained by ſuppoſing the union of the gaſtric acid with the earthy part of the bone. How the gaſtric acid is generated and evolved, remains to be aſcertained. Sugar, vegetables, and ardent ſpirits frequently turn ſour, when taken into the ſtomach.

As ſoon as food is forced into the *duodenum,* and eſpecially during its paſſage through the whole of the ſmall inteſtines, the more fluid part is attracted and entangled among the *villi,* and abſorbed by the beginnings of the

lacteal

The *Small Inteſtines* are again divided into

1. The *Duodenum*,
2. The *Jejunum*, and
3. The *Ilium*. Nevertheleſs, there are no characteriſtic ſigns, by which the *jejunum* can be diſtinguiſhed from the *ilium*.

The *Large Inteſtines* are ſubdivided into

1. The *Coecum*,
2. The *Colon*,
3. The *Rectum*.

They are all connected to the meſentery, except the *duodenum*, as before noticed.

Obſervation teaches, that the length of the inteſtines is more than ſix times the length of the body to which they belong (377).

Of

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lacteal veſſels; for the excrementitious part, ſuch as bile, is found apart in the inteſtines (Hunter's Obſ. p. 174.). The Chyle being ſeparated, the more ſolid matter is driven onwards, growing harder as it approaches nearer to the *rectum*, where by its bulk, figure, and acrimony it excites its own expulſion.

Of Chyle it may be obſerved, that in man and quadrupeds it is ſomewhat like milk. It has no odour, but is of a ſaltiſh taſte. When effuſed from the lacteals of a healthy man, it ſoon coagulates; and if a man be killed, during its abſorption from the inteſtines, it will be found coagulated in the lacteals. Like blood, when effuſed from weak animals, it coagulates only in part, the coagulated part ſwimming upon the uncoagulated part. Chyle is not acid, ſo that it cannot correct the tendency of the blood to putreſy, as Haller aſſerted. Kept two days, in the heat of ſummer, it did not become putrid (Cruikſhank's Anat. of the Abſorbing Veſſels, p. 100.).

(377) When Habicot (ſays Sabatier, *Du Canal Inteſtinal.)*

Of the Small Inteſtines in general.

The fabric of the ſmall inteſtines for the moſt part agrees with that of the ſtomach and *oeſophagus*; they have four tunics, named like thoſe of the ſtomach.

1. The *Outermoſt* ariſes from the *peritoneum*, or meſentery, and cloſely inveſts all the inteſtines, except only a part of the *duodenum*. By the intervention of this membrane and the meſentery, the inteſtines are kept ſteady, and confined in their proper place.

2. This is *Muſcular*. The fabric of this is like that of the muſcular coat of the ſtomach, differing only in this, that the longitudinal fibres are leſs numerous in the inteſtines. The circular fibres are in great plenty, and are poſſeſſed of exquiſite ſenſibility; they conſiſt of imperfect arcs, many of which form an entire circle. Between this coat and the former there is cellular membrane, which is often filled with fat.

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nal.) made his public demonſtrations in Anatomy to the medical ſchool at Paris, he found that the inteſtines were only four times as long as the ſubject. But Anatomiſts in general agree, that its length is not always the ſame; ſometimes only three or four times as long as the body, ſometimes ſeven or eight times.

It is imagined that the length of the inteſtines in *foetus* is greater, becauſe of the great quantity of *meconium* in them (Haller in his *Praelect. Acad. P.* II. *pag.* 358. *d.)*

3. The *Nervous Coat*, analogous to that of the ſtomach conſiſts of ſmall filaments, cloſely placed together; it is ſtrength in theſe, that gives ſtrength to the inteſtines. This coat hath veſſels coming from the cellular membrane, which is between this and the muſcular coat, and they paſs into the villous coat. Between this coat and the following, there is cellular membrane.

4. The *Inmoſt* or *Villous Coat.* This differs much from the villous coat of the ſtomach; for it conſtitutes, with the cellular membrane under it, large ſemilunar folds, eſpecially in the *duodenum* and *jejunum* (375). The whole internal ſurface of the ſmall inteſtines is covered

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(378) Theſe folds are called *Valvulae Conniventes (Kerkringii Spicil. Anat. p.* 89.), *Rugae*, and *Juga*. Ruyſch ſays the *rugae* are formed of the villous coat, and not of both the villous and nervous coats; for if the villous coat be ſeparated, the valves are deſtroyed, nothing remaining except their marks (Epiſt. Anat. XI. p. 9.). Albinus however gives a drawing, in which the villous coat being taken off, there remain the proceſſes of the nervous coat, which helped to form the *rugae (Acad. Annot. Lib.* III. *Cap.* IV.). Winſlow is of the ſame opinion as Albinus (*Expoſ. Anat. Tr. du bas ventre*, § 110.).

But though theſe *rugae* be called valves, they are not of the ſame figure as valves, nor do they perform a valvular office. In a word, their uſe ſeems to be that of forming a larger ſurface for the abſorption of chyle. They begin to appear in the *duodenum*, and they are moſt numerous in the *jejunum*; they are almoſt entirely wanting in the *ilium* and *colon* (Gliſſon.).

In figure, they are ofteneſt ſemilunar, never circular, and ſeldom longitudinal (Ruyſch, *Theſ. An.* I. *Aſſ.* I. *n.* 8.).

with innumerable *villi*, which are formed of the narrow ducts of lacteal *ampullulae* penetrating the internal coat. Beſides, many large and ſmall excretory ducts of ſimple and compound mucous glands open in the villous coat; many of which are ſituated in the third cellular membrane of the *duodenum*, but chiefly of the *ilium*. The ſimple glands are called from their diſcoverer's name, the Brunnerian Glands of the inteſtines (379). They all of them evacuate themſelves into the cavity of the ſmall inteſtines.

Their *Arteries* ariſe from the ſuperior meſenteric artery.

Their *Veins* all go to the *vena portae* (380).

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(379) Theſe Glands, as Brunner himſelf obſerved, may be found by boiling a piece of the inteſtinal canal, till it ſinks in water, and then ſtripping off the internal coat *(Tract. de Gland. Duodeni.)*. They are very large and conſpicuous near the *pylorus*, eſpecially in infants that have died of *diarrhoea*, or dyſentery.

Peyer, who likewiſe wrote on this ſubject *(Obſervat. de Gland. Inteſt.*—for theſe glands are alſo called *Glandulae Peyerianae)*, ſays they are ſituated on all ſides of the *villi* and *valvulae conniventes*, either at a diſtance from one another when they are called *Solitariae*, or contiguous to one another, called *Congregatae*. In the *duodenum*, they are large, but at a diſtance from one another; in the *jejunum*, they are ſmall, except near the *ileum*, when they become large; but at the end of the *ileum* they are very large and numerous.

(380) The ſmall trunks of arteries and veins, coming from the meſentery, divide into two, paſs over each hemiſphere of the inteſtinal canal, and run between the external and muſcular coats, in the cellular membrane, which is continued from the meſentery. Afterwards, they

Their *Nerves*, though ſmall, are very numerous. The *Duodenum* acquires its nerves from the poſterior *plexus* of the eighth pair. The nerves of the other ſmall inteſtines come from the middle *plexus* of the intercoſtal nerve.

The *Uſe* of the Small Inteſtines is to make chyle, and to abſorb it; alſo to propel the uſeleſs remains of food into the large inteſtines.

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they penetrate, between the muſcular fibres, into the nervous coat, where they anaſtomoſe frequently with thoſe of the oppoſite ſide, and run alſo into thoſe proceſſes of the nervous coat, which contribute to form the *valvulae conniventes* (See Note 378.). The Arteries and Veins accompany each other, the veins being always larger than the arteries. The Veins may be filled by injecting the arteries (*Alb. Acad. Annot. Lib.* III. *Cap.* XI. *p.* 52.).

The *Abſorbents of the Inteſtines* are ſcarcely noticed by Leber. He only mentions the lymphatic veſſels of the *colon* and *rectum*.—There are no lymphatic veſſels, ſtrictly ſo called, of the inteſtines, for the lacteals which take up chyle, when it is preſent, take up lymph, or other ſubſtances, when chyle is not preſent. The lacteals, which accompany the blood-veſſels of the inteſtines, are preciſely double their number, one on each ſide of the artery and vein. They are ſeated either ſuperficially, when they run longitudinally under the peritoneal coat of the inteſtine, or deeply, when ſituated under the muſcular coats, accompanying the arteries and veins. But the lacteals of both kind communicate, after the ſame manner as the cutaneous veins communicate with thoſe deeply ſituated in the extremities (Cruikſhank, p. 162.). The lacteals of the *jejunum* are much larger and more numerous than thoſe of the *ilium* (*Ibid. p.* 162.); and they of the *duodenum* are not inferior in ſize, or in number to thoſe of an equal portion of the *jejunum* (*Ibid. p.* 163.).

Of the Small Inteſtines in particular.

I.

The *Duodenum* is ſituated in the right epigaſtric region. Its name is derived from its length. It ariſes from the right orifice of the ſtomach, paſſes in a tranſverſe direction to the right ſide, and goes ſomewhat backwards as far as the neck of the gall-bladder; hence it deſcends on the right ſide, rather poſteriorly, from the right kidney to the inferior *laminae* of the meſocolon; between the ſuperior and inferior *laminae* of which it is encloſed. It afterwards goes, tranſverſely, towards the left, and behind the *pancreas*, and the trunk of the *vena portae*, before the *aorta*, and *vena cava* backwards; yet in ſuch a manner, that it aſcends rather forwards and upwards. It makes another curvature at the large ſanguiferous veſſels, as they were called, towards the right, and deſcends through the particular aperture placed there, where the tranſverſe part of the meſocolon and the meſentery of the ſmall inteſtines unite, into the inferior part of the abdomen; but at that aperture it changes the old name for a new one, and it is called *Inteſtinum Jejunum*. This inteſtine is looſe and capacious, eſpecially in its firſt windings, where it is not covered by the external *lamina* of *peritoneum* (³⁸¹). It is very red, having ſomewhat thicker muſcular fibres than any other of the ſmall inteſtines.

It hath *Arteries* proper to it, which are called, from the inteſtine, *Duodenales.* They come from the coeliac artery.

The *Duodenum* is perforated by the *Ductus Choledochus* and *Ductus Pancreaticus* poſteriorly, at four fingers breadth.

Its *Uſe.* It retains the *ingeſta* for a while, that it may be exactly mixed with the bile and pancreatic juice.

II.

The *Jejunum* was ſo called by the ancients, becauſe it is almoſt always empty, and becauſe its contents are for the moſt part liquid. It is averred, that this inteſtine may be diſtinguiſhed from the others, by its redneſs, its greater vaſcularity, and by its poſſeſſing fewer glands; alſo, by its being rather ſituated in the umbilical region (³⁸²).

The

(³⁸¹) The *duodenum*, which is the largeſt and moſt lax of the ſmall inteſtines, is oftentimes ſo large at the beginning, where the peritoneal coat is not continued over it, as to ſeem as if it were a ſecond ſtomach. Kulm and Sabatier call it "*Ventriculus Succenturiatus.*"

(³⁸²) As the inteſtines are one canal, the end of the *jejunum* and beginning of the *ileum* is not eaſily aſcertained. It remains for me only to obſerve in what manner Winſlow diſtinguiſhed them. Theſe are his words—"Theſe

III.

The *Ileon* at its origin ſcarcely differs from the preceding inteſtine in any thing. Nevertheleſs, the old Anatomiſts ſaid that its coats are whiter, its veſſels fewer, and its folds and glands more numerous; alſo that it is rather ſituated in the hypogaſtric and iliac region; but ſo hard is it to determine its beginning, that the illuſtrious Haller comprehended this and the former inteſtine under the common name of the *Small Inteſtine.* It ends in the right iliac region in the *coecum*, and in the *colon*, by its ſuperior part, under the kidney (383).

" Theſe two inteſtines (i. e. *jejunum* and *ileum)* may be better diſtinguiſhed by their different ſituations, which are pretty regular; but as even this mark is not particular enough, the moſt eaſy way that I have been able to contrive, and which will in moſt caſes be found ſufficiently exact, is to divide both inteſtines into five parts, and to allow nearly two fifths to the *jejunum*, and three-fifths and a little more to the *ileum (Du Jejunum* § 4. 123.).

(383) In the *Jejunum*, *Ileum*, and *Rectum*, a ſmall proceſs is ſometimes ſeen, ſomewhat like the *appendix caeci*. It ſeems to have been firſt obſerved by Ruyſch; but ſee Morgagni *(Adv. Anat. Animad.* V.), Sabatier *(Traite Comp.)*, &c. This proceſs is called *Diverticulum*, *Proceſſus Vermiformis extraordinarius*, &c.

Of the Large Inteſtines.

Before we examine the large inteſtines, we muſt conſider that valve, *Valvula Tulpii*, which is placed at the end of the *ileum*. It is formed, at the beginning of the colon, ſuperiorly and inferiorly of the villous and nervous coats, and the tranſverſe muſcular fibres of the *ileum* and *colon*, in ſuch a manner, that one ſoft, and moveable fold or valve protrudes from below upwards, and another like it extends from above into the cavity of the inteſtinal canal. Theſe valves do not unite together in the middle, but they incloſe an aperture, which reſembles a tranſverſe ridge (384).

Its *Uſe* conſiſts in this; that by its fabric, it tranſmits every thing going out of the *ileum*, but impedes the paſſage of the contents of the large inteſtines into the ſmall.

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(384) It is called the Valve of the *Ileum*, or of the *Caecum*, or of the *Colon*. It is perhaps beſt deſcribed by Morgagni (*Adv. Anat.* III.).

Morgagni firſt deſcribed two *Retinacula* or *Frena* of this valve. They ſerve, he thinks, to keep the valve itſelf in its proper place, and to produce a more exactly horizontal commiſſure. They are conſpicuous enough, ariſing within the colon, horizontally, from the extremities of the commiſſure. Where they are contiguous to the valve, they equal it in ſize; but they become leſs as they recede from it, and are at laſt altogether extenuated (*Adverſ. Anat.* III. *Animad.* XIII.).

The Small Inteſtines differ from the Large, becauſe

1. They are longer,
2. Their fabric is more tender,
3. They are ſmaller,
4. They are diſtinguiſhable from the large inteſtines, though cut off from them.

I.

The *Coecum* begins below the inſertion of the ileon. It may be conſidered as a production of the large inteſtine expanded into a large ſack. In length and breadth, it is about three or four fingers broad. It is placed in the right iliac region; but its blind extremity reſts upon the broad wing of the *os ileum*. Inferiorly, there projects from its external ſurface a long, ſmall proceſs, acute, variouſly bent, and covered internally with mucous glands; it is called the *Vermiform Proceſs* of the *coecum*. The glands within this proceſs ſecrete a mucus, by which the foeces are lubricated in their paſſage from the *ileum* (385).

The

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(385) This *appendix*, which is ſometimes wanting in man, ſeldom or never contains *foeces*. Morgagni relates an obſervation of one Zambeccarius, which is, that when a part of this appendix was cut off by a ligature, and three months had intervened, though the bottom of the *appendix* was open, yet no foeces paſſed out of it into the cavity of the abdomen (*Adv. Anat.* III. *Animad.* XIV.).

It

II.

The *Colon* is a production of the former; it is large and thick. Its fabric is alſo ſtronger than that of the ſmall inteſtines.

It ariſes in the right iliac region, and aſcends even to the angle of the right *hypochondrium*: it runs tranſverſely under the liver and ſtomach eſpecially to the ſpleen, in which place it is many times bent in a deep angle towards itſelf, under the left ribs; it deſcends from thence into the left iliac region, where it is again curved, paſſes into the *pelvis*, and is called the *Rectum*.

It is connected by particular ligaments with each kidney, and with the liver and ſpleen.

Its *Fabric*, generally ſpeaking, is ſimilar to that of the ſmall inteſtines, yet it differs,

1. Becauſe all the longitudinal muſcular fibres are united into three bundles, which

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It is larger in the foetus than in the adult, in proportion to the reſt of the body (*Heiſteri Comp. Anat. Tab.* VII. *Fig.* 30.). Haller oftentimes found it containing *meconium* (*Elem. Phyſ.* VII. *p.* 117.) Its uſe is not known.

Some Anatomiſts confine the name *coccum* to this appendix (Cheſelden, &c.)

The Glands, as Prof. Leber calls them, of this vermiform proceſs, are ſaid by Ruyſch to be of that kind of *cryptae*, which reſembles the ſeed of figs, or white poppies; they appear like ſmall knots, not like follicles, &c. (*Epiſt. Anat. ad Boerh. p.* 57.).

bundles ariſe from the vermiform proceſs, and run even to the end of the *colon*, where they are contracted into two only, two leſs becoming one larger. The bundles, now alluded to, are diſperſed throughout the whole *rectum*. The largeſt of the bundles is free; another is covered by the meſentery; the third is covered by the *meſocolon*.

2. Becauſe it hath more folds, and thoſe larger, delaying the faeces, in ſome degree, and obviating their return.

3. Becauſe the internal coat is thinner, deſtitute of *villi*, but ſupplied with many folds and pores.

4. Becauſe it hath more ſimple glands, evacuating their pores into the cavity of the inteſtine.

III.

The *Rectum* ariſes from the colon at the laſt *vertebra* of the loins; it is inclined ſomewhat downwards at its riſe, and is afterwards turned forwards, and terminated in the ſkin by an orifice called the *Anus*. This inteſtine is broad and ſmooth; it is the largeſt of the large inteſtines, and is covered with much fat. It reſts upon the internal ſurface of the *os coccygis* and *os ſacrum*; and it is connected not only to them, but alſo to the urinary bladder, the proſtate gland, and the *veſiculae ſeminales*, in men; and in women to the *uterus* and *vagina*.

Its

Its *Fabric* differs from that of the other inteſtines in this, that

1. It is only covered by the *peritoneum* anteriorly.

2. The muſcular fibres, which are longer and redder, wholly encloſe the inteſtine. We have noticed the circular fibres, which form the internal ſphincter muſcle at their extremity, and the other muſcles belonging to this part, in the *Myology*.

3. It is poſſeſſed of an internal coat replete with pores, ſmall, net-like folds, and particular *lacunae*, into which the excretory ducts of large mucous glands open.

The circumference of the *anus* is beſet with ſebaceous glands, which ſecrete a *ſmegma*, by which the *anus* is defended from excoriation by hard and acrid faeces.

The *Arteries* of the large inteſtines are the ſuperior meſenteric, the *Colica media*, and the inferior meſenteric. Various branches from the *Haemorrhoidalis media*, which comes from the poſterior iliac artery, likewiſe go into the *rectum*.

The *Veins* terminate in the gaſtro-colic, or internal hemorrhoidal vein, and hence in the *vena portae*; ſome nevertheleſs end in the *Haemorrhoidalis media* and *externa*, and in the trunks of the iſchiatic veins.

The *Lymphatic Veſſels* of the *colon* and *rectum* paſs into thoſe of the loins (356).

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(356) We have ſpoken of the abſorbents of the ſmall inteſtines

The *Nerves* of the large inteſtines ariſe from the left colic *plexus*, which comes from the eighth pair. Some come alſo from the lowermoſt intercoſtal, and others from the ſacral nerves.

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inteſtines already; it is neceſſary that there ſhould be abſorbents of the large inteſtines, if it were only to remove lymph. They are proportionally ſmaller than thoſe of the *jejunum.*

Cruikſhank never ſaw chyle in the great inteſtines, as Winſlow, Mery, and Haller did: he calls the abſorbents coming from the *coecum*, the *colon* of the right ſide, and tranſverſe arch of the *colon*, *Lactea colica dextra* (p. 164.).

OF THE

LACTEAL VESSELS;

OF THE

RECEPTACULUM CHYLI;

OF THE

THORACIC DUCT.

All theſe are treated of in the Doctrine of the Lymphatic Veſſels.

Of the Liver and Gall Bladder.

THE *Liver* is a *viſcus*, of a deep red colour, and of great ſize and weight, ſituated under the diaphragm, in the right *hypochondrium*, its ſmaller part occupying the epigaſtric region. In man the liver is divided into two lobes, of which the right is the larger. They are divided on one ſide by a broad ligament, and on the other ſide by a *foſſa*. It is between theſe two, that a third, the *lobulus Spigelii*, is ſituated.

We notice in the Liver,

I. *Four Ligaments*, all ariſing from the *peritoneum.*

1. The *Right Lateral Ligament*, which connects the thick, right lobe with the poſterior part of the diaphragm.

2. *The Left Lateral Ligament*, which connects the convex ſurface and margin of the left lobe with the diaphragm; and, in thoſe of whom the liver is very large, with the *oeſophagus* and ſpleen.

3. The *Broad* or *Middle Suſpenſory Ligament*; it paſſes from the diaphragm into the convex ſurface, and ſeparates the right lobe of the liver from the left. It deſcends from above through the large fiſſure to the concave ſurface, and is then diſtributed over the whole liver.

4. The *Round Ligament*, which in adults conſiſts of the umbilical vein indurated into a ligament.

Some Authors conſider, in this place, the external coat of the liver under the name of the *Coronary Ligament of the Liver.*

II. Two *Surfaces*, of which

The *Superior* is convex, and ſmooth,

The *Inferior* is concave, and has holes and depreſſions, to receive not only the contiguous *viſcera*, but the veſſels running into the liver beſides.

III. Two *Margins*; of which

The *Poſterior* and *Superior* is obtuſe, and

The *Anterior* and *Inferior* is acute.

IV. Two *Tubercles* at the entrance of the *vena portae.*

V. The *Fiſſure* in the concave ſurface.

VI. The *Sinus*, which is the ſeat of the gall-bladder.

The *Veſſels* of the liver carry blood, bile, lymph, and the nervous energy (387).

The *Blood-veſſels* are

1. The *Hepatic Artery*, which ariſes from the coeliac, and is inſerted into the concave ſurface of the liver: it alſo affords an artery for the gall-bladder; and brings blood for the nouriſhment of theſe parts (388).

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(387) The Liver, which in an adult fills only the right *hypochondrium*, and the anterior part of the epigaſtric region, and never extends farther downwards than the margin of the ribs, occupies, in a *foetus*, almoſt the whole abdominal cavity. It often extends as far down as the *criſta* of the *ileum* on the right ſide. It often deſcends anteriorly below the navel; and on the left ſide it occupies the whole hypochondriac region, and ſo covers the ſtomach, ſpleen, kidney, and *capſula renalis*, that they can only be ſeen by removing the left lobe of the liver.

In an adult the right lobe is larger than the left; but in a foetus, previous to the action of the ſtomach, both lobes are perhaps of the ſame ſize.

The ſuperior ſurface of the liver in a *foetus*, ought rather to be called the anterior. It is more convex in foetus, not having been preſſed againſt the diaphragm. The inferior ſurface, or, more properly, the poſterior ſurface, is irregular, and very different from that of adults.

(388) Beſides the hepatic artery, the liver has branches from the large coronary artery of the ſtomach, and from the trunk of the meſenteric artery, which branches are large:

2. The *Umbilical Vein* carrying blood in the *foetus* from the mother into its liver; its ſeat is the *ſinus* of the liver. One of its branches, called *Canalis Venoſus*, is inſerted into the *vena cava*; the reſt into the *vena portae*.

In adults the *canalis venoſus* is totally obliterated.

3. The *Vena Portae* is a large trunk formed of the veins of the ſmall and large inteſtines, the ſtomach, ſpleen, *omentum*, and pancreas. Its coats are ſtrong and thick. It is inſerted into the cavity of the leſs lobe, on the right ſide, and is then divided into branches, of which the right, which is the larger, goes into the right, or large lobe; and the left, or ſmaller, goes into the left lobe, and the *Lobulus Spigelii*.

Where the *vena portae* enters the liver, it acquires a ſtrong tunic, which is formed of cellular texture, conſiſting of ſmall veſſels and hepatic nerves: this ſtrong tunic accompanies the *vena portae* throughout the whole liver, and is called *Vagina Gliſſonii*. Each branch of the *vena portae* is divided into many others, and theſe into leſs, which are deſtined for the ſecretion of bile.

4. The *Vena Cava* aſcends poſteriorly through the *lobulus Spigelii* to the tendinous *foramen* of the diaphragm. In this courſe it receives veins from the external branches of the *vena portae* and the hepatic artery, and

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large: it moreover receives ſmall branches from the phrenic, mammary, capſular, and renal arteries (Marherr, *in* Boerh. § 340.).

thus

thus returns the blood of the liver to the heart (389).

The *Lymphatic Veſſels* are numerous. They ariſe, on all ſides, on the convex and concave ſurface of the liver, under the external covering: they diſgorge themſelves into the thoracic duct.

The *Biliary Ducts* ariſe in every part, and from the whole ſubſtance of the liver from the extreme ends of the *vena portae:* then they run together into large branches, and again into two only, and, in the ſinus of the liver, at the ſmaller lobe, into one branch, called *Ductus Hepaticus:* this hepatic duct is afterwards joined with another, called from its origin, *Ductus Cyſticus.* When theſe two ducts are joined together, they have the common name of *Ductus Choledochus*. The *Ductus Choledochus* deſcends, behind the *duodenum*, towards the *Pancreas*, and is implanted in the *duodenum*, at about ſix inches below the inferior orifice of the ſtomach; then having paſſed a certain way, between the coats of the *duodenum*, it is joined to the pancreatic duct, between the ſecond and third coats: hence the bile and pancreatic juices being blended together, are poured out into the cavity of the *duodenum*.

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(389) The *vena cava*, as it paſſes through the liver, is ſmaller than it is below, near the kidneys. It receives, however, the hepatic veins in its courſe, which ariſe partly by a reflected canal from the arterial extremities of the *vena portae*, and partly from the ends of the hepatic artery, and running through the convex part of the liver, encreaſed by branches coming from all parts of the liver, form more or fewer trunks, but ſeldom more than ten, which enter the *vena cava*, and pour into it the blood left after the ſeparation of the bile. Beſides, many other ſmaller hepatic veins enter the *vena cava* from the *Lobulus Spigelii.*

If the *vena portarum* returned blood from the liver, after the ſecretion of bile, which is hardly to be believed, how comes it to paſs, that by tying the meſenteric, ſplenic, and ſome other veins, the *vena portae* is ſoon ſeen empty, and the veins between the ligature and their origin diſtended with blood? In ſhort, it is clear, that the courſe of the blood in the *vena portae* is from a larger to a leſs diameter, as in the arteries.

The *Nerves* of the Liver are very numerous: they are from the great intercoſtal nerve, and from the eighth pair, and go along with the hepatic artery and *vena portae* into the liver.

The Internal Fabric of the liver is not perfectly known; yet there are ſome proofs of its being vaſcular, and not glandular (390).

The

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(390) It has been doubted whether the liver be glandular or not; Ruyſch maintaining, againſt Malpighi, that it is vaſcular. We think the latter in the right, becauſe there is a communication between the ends of the hepatic ducts, and the arterial ramifications of the *vena portae*; between the branches of the hepatic duct, and thoſe of the hepatic artery; between the branches of the hepatic artery, and the ends of the *vena portae*; between the branches of the hepatic duct, and thoſe of the hepatic veins and *vena cava*; ſo that a liquor injected into the one returns eaſily by the other; which can hardly be thought to happen, if there be intervening follicles: but Malpighi's followers never ſaid poſitively that they had ſeen follicles, or glands, either in the liver of man or brutes: and it ſeems from the experiments above alluded to, that the whole liver is compoſed of the veſſels there mentioned, and cellular membrane.

But

The chief *Uſe* of the liver is to ſecrete bile, for the diſſolution of the aliment; and to carry it not only into the *duodenum*, but backwards into the gall-bladder.

Moreover, it ſeems that in conſequence of the liver in *foetus*, in which there is no uſe for bile, as their liver is very large, the *impetus* of the blood flowing out of the *placenta*, and all the veſſels of the abdomen, muſt be leſſened.

The *Gall Bladder* is a membranous receptacle, connected to the *ſinus* of the right lobe of the liver, tranſverſely from behind forwards, in ſuch a manner, that its obtuſe hemiſpherical part, called the *Fundus*, projects forwards at the margin of the liver, and lies upon the *colon*; and its narrow part, or *Neck*, is

But as the liver is intended for the ſecretion of bile from the blood, it has been agitated, whether it is ſeparated from the *vena portarum* only, or from the hepatic artery, or from both at the ſame time. That it is not ſecreted by the gall-bladder itſelf, as Sylvius dreamt, is certain (Note 391.). The moſt approved opinion is that given in the text. The reaſons in favour of it are derived not only from conſidering the fabric of the *vena portae*, which ramifies throughout the liver after the manner of an artery, and does not beat like it; but alſo the proportion between its branches and the hepatic ducts: for the hepatic ducts are much larger than the branches of the hepatic artery, but not than thoſe of the *vena portae*. Therefore the larger ſize of the ramifications of the *vena portae* ſeems better fitted to convey a larger quantity of blood, and to make a more copious ſecretion. Another argument is afforded by Malpighi's experiment, who tied up the hepatic artery of a living animal, without either preventing the ſecretion, or flowing of bile into the hepatic duct.

is turned backwards. This neck, at its beginning, is bent backwards towards its ſelf, then aſcends, and ends in the cyſtic duct; which duct, as ſaid before, when united to the hepatic duct, conſtitutes the *Ductus Choledochus* (391).

The *Cyſtic Duct* is internally beſet with many large folds, and the bladder itſelf with many ſmall.

The ſize of the gall-bladder is different in different perſons. In a ſubject of the common ſize, and in a natural ſtate, it contains two or three ounces of bile.

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(391) In a foetus, the gall bladder is cylindrical, and not pyriform, as in an adult; neither does it extend beyond the anterior margin of the liver, as in an adult.

That bile is not ſecreted by the gall-bladder itſelf, but brought into it from the liver by the hepatic duct, is, I think, certain. For if the cyſtic duct be tied, or otherwiſe obſtructed, no more bile paſſes into it. Beſides, when the proper duct of the gall-bladder is obſtructed, an aqueous liquor is ſecreted in that bladder, and bile is only found in the hepatic duct, and *ductus communis choledochus*: which proves, as Haller obſerves, that the ſecretion of bile is confined to the liver, and that bile, *quaſi* bile, is really formed, without the addition of any thing from the gall-bladder (*Opuſc. Path.* p. 79. 80, and in other parts of the ſame *Opuſcula.*). Laſtly, there are animals, as the ſame author affirms, that have no gall-bladder, but yet have good bile, ſuch are elephants, horſes, ſtags, &c.

Fab. Ab Aquapendente obſerved, that the gall-bladder of a *fœtus* contains no bile (*Op. Anat. et Phyſ. Lipſ.*). Wriſberg found it full of a gelatinous matter, neither bitter nor inflammable (*Deſc. Anat. Emb. Obſ.* I. § 25.): but he agrees with Fabricus (*Obſ.* II. *n.* 10. *Obſ.* III. *n.* 16. *Obſ.* IV. *n.* 16. *Obſ.* V. *n.* 18.). Frid. Roeſslein always found the gall-bladder full of bile in *fœtu* (*Diſſ. Inaug. Anat. Phyſ. De Differentiis inter Foetum et Adultum, p.* 64. *Argentorati*, 1783.).

The Gall-bladder reſembles in figure a pear.

Its *Coats* are

1. The *External*, which covers the whole gall-bladder, comes from the external covering of the liver; and accordingly from the peritoneum. Under it there is cellular membrane, which is often filled with fat. Through this cellular membrane there are lymphatic veſſels, and many blood-veſſels diſtributed.

2. The *Muſcular*, conſiſting not of red, but of white, gliſtening fibres which paſs along the whole length of the gall-bladder, and are obliquely decuſſated one with another. Under this tunic there is likewiſe a cellular texture, in which there are arteries forming a beautiful net-work.

3. The *Nervous*, which is very like that of the inteſtines. This hath a third layer of cellular texture under it.

4. The *Villous*, which is of the ſame fabric as the villous coat of the inteſtines, except only, that, as in the biliary ducts, it forms cells and little net-works, and produces *rugae*, which run towards the neck of the bladder, in the direction of its length.

In the middle of the bladder, and about its neck, there are ſmall glands, which ſecrete into its cavity a red *mucus*.

In brutes there are particular ducts which paſs from the liver into the gall-bladder; but ducts, like theſe, have never been demonſtrated in man (392).

The *Veſſels* and *Nerves* of the gall-bladder come from the liver.

Its *Uſe*. It ſerves to detain the bile that is brought from the hepatic duct through the cyſtic duct, until the very fluid part of it is abſorbed, and the remains made more bitter, more acrid, and thicker: but not only by the preſſure of the *duodenum* and ſtomach, which when full, acts immediately upon the gall-bladder, but likewiſe by other cauſes in the ſame paſſage, through which the more fluid bile had paſſed, the bile is again brought into the cyſtic duct, and thence, through the *ductus choledochus* into the *duodenum* (393).

The Bile ſerves for the exact mixture of the digeſted food; for the completion of the chyle, and the preſervation of the periſtaltic motion of the inteſtines (394).

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(392) Theſe are called *Ductus Cyſt-hepatici*, or *Hepatico-cyſtici* (Winſlow, *Exp. Anat. Sect.* 8. § 297.).

(393) The Bile of the hepatic duct flows conſtantly, as blood flows conſtantly into the liver from the *vena portarum*; but the cyſtic bile does not always flow: it requires certain cauſes to make it flow.——Hepatic bile paſſes perpetually through the hepatic duct into the *duodenum*, its paſſage being favoured not only by the oblique deſcent of the duct, but alſo by the gravity of the bile itſelf.——Cyſtic bile is determined into the *ductus choledochus*, not by the preſſure of a full ſtomach, for it is clear that the *pylorus* ends on the left ſide, and conſequently, that it cannot affect the gall-bladder; but by its own accumulation and acrimony, and eſpecially by the motion of the diaphragm and abdominal muſcles. This indeed does happen in general when the ſtomach is full, and when chylification commences. It alſo takes place, when the ſtomach is empty, from the action of the diaphragm and abdominal muſcles.

Of the Spleen.

The Spleen is a ſpongy *viſcus*, of a livid colour, and ſo variable in form, ſituation, and magnitude, that it is hard to determine either. Nevertheleſs, in a healthy man, it is always placed on the left ſide, in the left *hypochondrium*, between the eleventh and twelfth falſe ribs (395). Its circumference is oblong and round, reſembling

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(394) Bile. I am certain that the uſe of the bile is not known; and that our knowledge of the function of the Liver is very imperfect.—I imagine the firſt uſe of the bile noticed by Leber to be founded on a falſe principle, i. e. its ſuppoſed ſoapineſs. For I have obſerved, treating of digeſtion (Note 376.), that bile is found apart from the other matters contained within the inteſtines; and I have obſerved (Note 387.) that the liver of a *foetus*, in which there is no bile ſecreted, almoſt entirely fills the abdomen.

As to its keeping up the periſtaltic motion of the inteſtines, I have no doubt of that effect. But I have ſeen white *faeces* free from the leaſt tincture of bile, diſcharged for a long time, without coſtiveneſs. And I am much diſpoſed to believe, that the gaſtric liquor, whether alone, or united to other matters, often keeps up the periſtaltic motion, independent of the bile, and excites *diarrhoea* when in too large a quantity, or when too acrid. The ſenſation of hunger I have already attributed to the gaſtric liquor (Note 376.).

How one fluid ſo bitter can contribute to make another ſo bland as chyle, though it is aſſerted by many, I am not enough verſed in the doctrine of taſtes to determine.

(395) The Spleen in a *foetus* lies obliquely; ſo that its extremity, which is the ſuperior in an adult, whoſe ſtomach is full, is alſo ſuperior in a *foetus*; but rather towards the right ſide, filling the ſuperior and poſterior part of the epigaſtric region. Its inferior extremity is wholly in the left *hypochondrium*.

ſembling an oval figure. It is larger, to ſpeak generally, when the ſtomach is empty, and ſmaller when it is compreſſed and evacuated by a full ſtomach.

It ſhould particularly be remembered of this *viſcus*, that it is convex towards the ribs, and concave internally; alſo, that it has an excavation, into which veſſels are inſerted.

It is *connected* with the following parts:

1. With the Stomach, by a ligament and ſhort veſſels.
2. With the *Omentum*, and the left kidney.
3. With the Diaphragm, by a portion of the *peritoneum*.
4. With the Beginning of the Pancreas, by veſſels.
5. With the Colon, by a ligament.

In man, the Spleen is covered with one, ſimple, firm membrane, ariſing from the *peritoneum*, which adheres to the ſpleen very firmly by the intervention of cellular texture.

The *Veſſels of the Spleen* are,—the *Splenic Artery* coming from the coeliac artery, which, conſidering the ſize of the ſpleen, is much larger than is requiſite for the mere nutrition of it. This goes, by ſerpentine movements, out of its courſe, over the *pancreas*, and behind the ſtomach; and after having given off branches to the adjacent parts, it is inſerted into the concave ſurface of the ſpleen. It is afterwards divided into ſmaller branches, which are again divided into other yet ſmaller, delivering their blood immediately to the veins,

but

but emitting it no where elſe (396). The *Veins*, at length, come together into one, called the *Splenic Vein*, and having received the large coronary vein of the ſtomach, beſides others, it conſtitutes the left principal branch of the *vena portae.*

The *Nerves* of the ſpleen are ſmall; they ſurround the arteries with their branches; they come from the particular *plexus*, which is formed of the poſterior branches of the eighth pair, and the great intercoſtal nerve (397).

Lymphatic Veſſels are almoſt only ſeen creeping along the ſurface of the human ſpleen (398).

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(396) Malpighi believed little follicles to be in the ſpleen, interpoſed between the ends of the arteries, and the beginnings of veins; but Ruyſch's doctrine ſeems more likely, ſince a liquor injected by the ſplenic artery eaſily returns by the ſplenic vein, and Haller declares this never fails, but ſucceeds eaſier than in any other *viſcus (El. Phyſ. T.* IV. *p.* 403.).

(397) As the nerves of the ſpleen communicate with the nerves of the ſtomach and inteſtines, through the ſemilunar ganglion, if the ſpleen be taken from a living man, the ſtomach and inteſtines always ſuffer by the loſs; are affected with ſpaſms, &c. *borborygmus*, *nauſea*, and vomiting, from the vicinity and ſympathy of the inteſtines and diaphragm (Boerh. *Inſt. Med.* § 327.).

(398) The ſuperficially ſeated lymphatics, to which the text alludes, are difficultly diſcovered in man. They run on the convex ſide of the ſpleen towards the concave edge, where its arteries are entering, and there join the deeply ſeated ſet. Theſe latter, as in the kidney, accompany the veins through the ſubſtance of the ſpleen, and having

The *Uſe* of the Spleen has not hitherto been determined; yet if its ſituation and fabric be regarded, one would imagine its uſe to conſiſt chiefly in detaining the blood for ſome ſpace of time, diſſolving it by its warmth, and rendering it more fluid (399).

Of the Pancreas.

The *Pancreas* is the largeſt of all the ſalival glands. Its breadth is nearly equal to the breadth of two fingers, and its length is nearly equal to the length of one.

It is *ſituated* in the epigaſtric region, behind the ſtomach, and before the left ſuprarenal gland, and the *aorta*, in the triangular ſpace of the *duodenum*.

Its *Colour* is livid.

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having emerged from its ſubſtance, enter glands lying upon the ſplenic artery. In their courſe through theſe glands, they receive the abſorbents of the pancreas, and blended with thoſe from the ſtomach, and ſome from the liver, near the head of the pancreas, they paſs with them into the thoracic duct (Cruikſhank, p. 182.).

(399) Mr. Hewſon ſuppoſed the ſpleen, which he affirmed to be vaſcular, to concur with the *thymus* and lymphatic glands in forming the red globules of the blood. Dr. Crawford aſſigns to them another uſe (See Note 338.); but as the excretory duct has not yet been found, the uſe of the ſpleen is yet unknown. However, moſt Anatomiſts imagine it to contribute to form the bile (See Heiſter, (*Comp. Anat. not.* 21 *.).

Its *Length* is eight or nine inches.

Its *Figure* is like that of a dog's tongue, its broad part being turned towards the *duodenum*, and its pointed part towards the ſpleen. It ariſes from a deep fiſſure in the ſpleen, and paſſes almoſt tranſverſely to the *duodenum*, into which the excretory duct of the pancreas is implanted.

It is *divided* into

1. Its *Sharp Extremity*, on the left ſide, oppoſite the ſpleen; and its *Broad Extremity*, on the right ſide, affixed to the *duodenum*.

2. Its *Superior* and *Inferior Surface*.

3. Its *Anterior* and *Poſterior Margin*. The excretory duct is in the poſterior margin.

It is *compoſed*, like all the other ſalival glands, of numerous very ſmall, ſimple glands, connected together by cellular membrane, and evacuating their liquor into the common duct. This duct is white and ſmall; it ariſes from the ſharp extremity of the pancreas, runs through the middle of the gland, and being united with the *ductus choledochus* between the coats of the *duodenum*, it opens into the cavity of the *duodenum*.

It is *connected* with the ſtomach and ſpleen, by means of membranes, with the *duodenum*, by the pancreatic duct.

Its *Arteries* ariſe from the duodenal and meſenteric arteries, and from the pyloric artery, c. s. p.

Its *Veins* end in the duodenal, meſenteric, and ſplenic veins, e. s. p. (398).

Its *Nerves* are ſmall; they ariſe from the poſterior gaſtric *plexus*, and from the hepatic and ſplenic *plexus*.

The *Uſe of the Pancreas* is to ſecrete a liquor like *ſaliva*, and to pour it into the *duodenum*, through its excretory duct.

The *Uſe of the Pancreatic Juice.* It dilutes the bile brought back from the gall-bladder; it diminiſhes its acrimony, and mixes it with the *ingeſta* (399).

Near the *pancreas* there is ſeen a gland, ſmaller than it, but alike both in form and fabric. Its duct opens into that of the *pancreas*. It is called the *Little Pancreas.*

It is ſituated inferiorly and anteriorly, where the pancreatic duct is implanted in the *duodenum.*

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(398) Haller was uncertain whether the *pancreas* have lymphatics or not; but Cruikſhank has often ſeen them, riſing out of the *pancreas*, and joining the ſplenic *plexus* (p. 183.).

(399) The pancreatic juice is ſomewhat like *ſaliva*, differing however in being more viſcid. De Graaf ſays it is acid *(De Succo Pancreatico. Cap.* 4. 5. and 6.); and that it effervesſces with the bile; but it is certainly not acid (Haller's *Elem. Phyſ. T.* VI. *p.* 450.). Mixed with the bile, no efferveſcence follows; and, in ſome animals, it is not even mixed with the bile, becauſe of the great diſtance between the orifice, by which it is poured out into the inteſtines, and that of the *ductus choledochus.*

Of the Supra-renal Glands, the Kidneys, the Ureters, and the Urinary Bladder.

The *Supra-renal Glands* are two hollow bodies, like glands in fabric, and placed, one on each ſide upon the kidney. They are covered by a double tunic, and their cavities are filled with a liquor of a browniſh red colour. Their figure is triangular, and they are larger in foetus than the kidneys; but in adults they are leſs than the kidneys. The right is affixed to the liver; the left to the ſpleen and pancreas, and both to the diaphragm and kidneys.

They have Arteries, Veins, Lymphatics, and Nerves.

Their *Arteries* ariſe from the diaphragmatic arteries, the aorta, and the renal arteries.

The *Vein* of the right ſupra-renal gland empties itſelf into the *vena cava*; that of the left into the renal vein.

Their *Lymphatic Veſſels* paſs to the thoracic duct.

There are *Nerves* common alike to theſe glands and the kidneys.

They have no *Excretory Duct*; and as for their *Uſe*, it is altogether unknown (400).

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(400) Perhaps theſe glands anſwer one uſe in the *foetus*, and another in the adult; but what theſe uſes are it is uncertain.

The *Kidneys* are two *viſcera* of a paliſh red colour, a firm conſiſtence, and a figure ſomewhat like a bean. They are ſituated without the *peritoneum* in the lumbar region, on each ſide of the ſpine. They lie upon the *pſoas magnus*, the *quadratus lumborum*, and the *tranſverſus abdominis* muſcles, in ſuch a manner, that the right kidney is placed under the liver, ſomewhat lower than the colon, and more poſteriorly; but the left kidney is placed under the ſpleen, the ſtomach, the pancreas, and the

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uncertain. Boerhaave ſuppoſed their uſe to conſiſt in furniſhing lymph to dilute the blood returned after the ſecretion of urine, in the renal vein; but this is very improbable, ſince the vein of the right ſupra-renal gland goes to the *vena cava* (Inſt. Med. § 364.); and the blood carried back by the renal vein wants no dilution. It has alſo been ſaid, that theſe glands not only prepare lymph, by which the blood is fitted for the nutrition of the delicate *foetus*; but that in adults, they ſerve to reſtore, in themſelves, to the blood of the *vena cava*, the irritable parts which it loſes by the ſecretion of bile and urine (*Diſ. Inaug. anatomico-phyſ. de gland. ſupra-renalibus: praeſ.* Joanne Chriſt. And. Mayero: *defend.* Jo. Ch. Heinſ. Schmidt. *Hamb. Traj. ad Viadrum.* 1785.). This is a very ſingular doctrine, though the author imagines the ſituation, and motion which they neceſſarily ſuffer, from the contiguous diaphragm; the large quantity of blood which they receive from the *aorta*, and the bitter and ſtyptic taſte of their contained fluid, as proofs. Some again have conſidered them as *diverticula*, in the *foetus*, to divert the blood from the Kidneys, and leſſen the quantity of urine; but if this were true, why do they remain in adults, and not diſappear like other *diverticula?* The celebrated Morgagni believed their office to conſiſt in conveying ſomething to the thoracic duct (*Adverſ. Anat.* III. *Animad.* 31.): but their uſe is unknown.

colon, rather higher and more anteriorly than the left (401).

The *Length* of each kidney is equal to about five or ſix fingers; the *Breadth* is equal to four.

We notice in the Kidneys:

Two Surfaces, of which

The *Anterior* is towards the cavity of the abdomen; and the *Poſterior* towards the ſpine.

Two Margins, of which

The *External* is convex, and

The *Internal* is concave, uneven, and hollowed to receive the renal veſſels.

Two Extremities,

The *Superior* of which is thick (402).

The *Inferior* is long, ſmooth, and ſmall.

The Right Kidney is connected with the liver, the colon, the diaphragm, and the ſpleen, by means of peritoneum; and both are joined by it, to the ſupra-renal glands, and by the ureters, to the urinary bladder.

The *Veſſels* of the Kidneys are

The *Renal Arteries*, which are large, coming from the *aorta*.

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(401) In a foetus the kidneys are lobular, and Hervey ſays they are white before the fourth month (*De Gener. Anim. p.* 249.). But in the adult, they are ſmooth, and covered with a proper membrane. The number of *lobuli* in the kidney of a foetus, correſponds to the number of *papillae* in the adult kidney.

(402) Hence it is eaſy to tell from which ſide a kidney is taken.

The *Veins*, which go into the large *vena cava.*

The *Lymphatic Veſſels*, which end in the thoracic duct (403).

The *Nerves*, which come from the ſemilunar ganglion of the eighth pair, and the intercoſtal nerve.

The *Excretory Duct*, which I ſhall hereafter deſcribe under the name of an *Ureter.*

The *Fabric* of the Kidneys is three-fold, viz. it is compoſed

1. Internally, of red, ſoft fleſh, called the *Cortical Subſtance*, which cortical ſubſtance conſiſts of many ſmall veſſels.

2. Of many ſmall *glands*, which have arteries, veins, and lymphatic veſſels.

3. Of *Papillous Subſtance*, which conſiſts of ten, or eleven, *papillae*, from which ſmall membranous canals ariſe, and terminate in the common *infundibuliform* cavity, which is called the *Pelvis* of the Kidneys. Each of

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(403) Mr. Cruikſhank could ſeldom diſcover the ſuperficial abſorbents of the kidneys, unleſs they were diſeaſed. He ſays—" They run from the outer edge of the kidney towards the inner, where they either blend in with the deeper ſeated, or go ſeparately to be inſerted into the lumbar glands. Theſe I have uſually diſtinguiſhed by the name of *lymphatica renis exteriora.*"—The *lymphatica renis profundiora* run along with the renal artery and vein, and end in the lumbar glands, near the origin of the renal artery. There is alſo another ſet of abſorbents belonging to the *pelvis* and *ureter* (Cruikſ. p. 159.).

theſe *papillae* is covered with a membrane called its *Calix* (404).

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(404) Moſt writers only mention two ſubſtances, as component parts of the kidney, viz. the external or *cortical* part, which is glandular, according to Malpighi, and vaſcular according to Ruyſch (Theſ. Anat. III.); and the internal or *medullary* part; but Leber, like Winſlow, has mentioned three ſubſtances (*Winſl. Exp. Anat. Sect.* VIII. § 409.). In the cortical part there are evident little ſpots, ſo that with the veſſels of the kidney, they reſemble a gooſeberry buſh, with its fruit; but theſe ſpots are perhaps only veſſels coiled up, and not little cells, as Malpighi believed. For my own part, I cannot diſtinguiſh but two ſubſtances, and am inclined to believe that the greater vaſcularity and conſequent redneſs at the baſe of the internal ſubſtance gave riſe to the threefold diviſion; for as to the lighter colour of the apex of the *papillae*, it clearly ſeems to depend on the ſmallneſs of their veſſels. The medullary part, which is more properly called by ſome *tubular*, from its appearance differs not in its ſtructure from the *papillary* or inward ſubſtance, and is confeſſed by Winſlow to be no more than a continuation of it. This medullary part is diſtinguiſhed from the reſt by the rectilinear courſe of its veſſels; for numerous ſmall veſſels which paſs from the cortical part in ſtraight lines, come together, and end in the concave part of the kidney, in obtuſely conic *papillae*; theſe *papillae* are connected to one another by cellular membrane; their number is uncertain, from eight to ſeventeen. In the apex of each *papilla*, there are little holes, in greater or leſs number, as the *papilla* is thicker or ſmaller. Theſe openings pour forth the urine; they are continued from the renal artery, or the little *globoſa corpora*, and are called from Bellini *Fiſtulae Bellinianae*, or the *Tubuli urinarii* of Bellini. Each *papilla* has its *calix*, or *infundibulum*, unleſs two papillae come into one *infundibulum*, which often happens. Theſe *infundibula* are of a cylindrical form, but rather narrow at the apex of the *papillae*;

The Kidneys are covered externally with a ſtrong, firm tunic, which adheres cloſely to them, but does not come from the *peritoneum*. This tunic is connected with the *peritoneum* by cellular membrane, which is often filled with fat.

As for the *Uſe* of the Kidneys, they ſecrete urine from the blood, and carry it to the Ureters.

The *Ureters* are two membranous canals, each of which ariſes from the *pelvis* of its proper kidney, and deſcends covered with *peritoneum*, over the *pſoas magnus* muſcle, and the large crural veſſels, into the *pelvis*, in which it perforates the urinary bladder, very obliquely and laterally on the poſterior part, inferiorly towards the neck; ſo that it runs for ſome ſpace between the coats of the bladder, before it opens into the cavity (405).

The *Capacity* of the Ureters is not always the ſame; they are generally larger at the beginning and end. The *Length* of each ureter is about the breadth of one's hand; their *Courſe* is like the italic letter *S*.

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pillae; the *infundibula* at length come together, and form three larger *infundibula*, which go out from the *pelvis* of the kidney, and unite into one, which is the beginning of the *ureter*. Thus all the urine that is brought through the *papillae* muſt paſs into the *infundibula*, and from thence into the *pelvis* of the kidney, to be conveyed to the *ureter*.

(405) This oblique inſertion of the ureters hinders the return of urine from the bladder.

They are compoſed of various tunics, of which

The *Firſt* and *Outerwards* is formed of cellular texture;

The *Second* conſiſts of a very fine cellular membrane;

The *Third* is a white, firm, nervous membrane;

The *Fourth* and *Inmoſt* is perforated by the excretory ducts of mucous glands diſtributed between the tunics; hence it is always covered with much mucus.

Their *Nerves* and *Veſſels* come from contiguous parts.

Their *Uſe*. They carry the urine ſecreted in the kidneys into the bladder.

The *Urinary Bladder* is a membranous bag, partly oblong and partly round, ſituated, without the *peritoneum,* in the anterior part of the cavity of the *pelvis*, and connected to the *pubis* by a large quantity of cellular membrane.

In man, it is ſituated between the bones of the *pubis* and the *rectum:* in woman between thoſe bones and the *uterus*.

We may obſerve in the urinary bladder

The *Upper Part*, which is large:

The *Fundus*, and the *Under Part*, which is narrow, called the Neck of the Bladder.

The *Anterior Part*, which is ſmooth:

The *Poſterior Part*, which is convex:

The *Two Lateral Parts*.

Its connection, in man with the *rectum*, and in woman with the *uterus*, and in both with the *oſſa pubis*, is by means of cellular membrane and muſcular fibres. Its *fundus* is attached to the *peritoneum*, and to the navel by the *urachus*.

The *Neck* of the Bladder ends anteriorly, by a narrow orifice, in a large canal, called the *Urethra*.

The *Urethra* is compoſed of

1. A Membrane, which is a production of the *epidermis*;

2. A Firm, Nervous Tunic, and

3. A Rare Cellular Membrane between the two former; which cellular membrane is called the *Corpus Spongioſum Urethrae*. It is this laſt, that with the firſt membrane conſtitutes the *Glans Penis*.

We may obſerve that the *urethra* is narrower by half poſteriorly at its beginning than any where in its courſe beſide. It is ſurrounded at its origin by the Proſtate Gland; but at a ſmall diſtance from this it is ſurrounded by the *Bulb*, as it is called, *of the Urethra*. Superiorly and laterally are placed the *Corpora ſpongioſa*, but the *urethra* itſelf is between theſe two bodies, and anteriorly perforates the *glans penis*.

The *Muſcles of the Urethra* may be learned in the Myology.

The neck of the bladder is united with the angle of the *oſſa pubis*, by means of a ligament,

ment, and with the *penis* by means of the *urethra*.

The bladder is connected with the kidneys by the ureters.

The Bladder is compoſed of the following coats:

1. The *Cellular Coat*, by means of which it is joined to contiguous parts.

2. The *Muſcular Coat*, conſiſting of a great number of irritable fibres interwoven one with another, which fibres ariſe principally from the *oſſa pubis*, aſcend to the *fundus* of the bladder, climb over it, and paſs along the bottom of the bladder, downwards to the proſtate again. Hence, when theſe fibres act, the bladder muſt of neceſſity be drawn downwards, and thus the urine is urged into the lowermoſt part, or neck of the bladder.

The other muſcular fibres ariſe from the proſtate, and ſurround the bladder in an oblique and tranſverſe courſe.

3. The *Nervous Coat*, which is the moſt ſenſible in the bladder; it is like the nervous coat of the ſtomach. Between this and the former, there is a very fine cellular texture.

4. The *Internal Coat*, which is a continuation of the epidermis of the body, and like it, may be reſtored when deſtroyed. It unites firmly with the nervous coat, and forms various folds. It is always lined with *mucus*, which is ſecreted through the excretory ducts of glands penetrating the internal tunic.

The *peritoneum* covers only the *ſundus* of the bladder. It covers it poſteriorly almoſt at the ingreſs of the ureters, where it recedes from the bladder, and, in men, goes to the *rectum*, and, in women, to the *uterus*.

The *Arteries* of the Bladder come from the iliac and umbilical arteries.

The *Veins* are branches, of the ſame name as the arteries, ending in the great *vena cava*.

Its *Lymphatic Veſſels* are ſeen in the firſt cellular texture (406).

Its *Nerves* ariſe from the third, fourth, and fifth pair of ſacral nerves; ſome likewiſe come from the hypogaſtric plexus, which is formed of the intercoſtal nerve.

The *Uſe* of the Bladder is to receive and retain, for ſome length of time, the urine brought from the kidneys by the ureters, and laſtly to evacuate it, from the body, by the *urethra* (407).

Of

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(406) The abſorbents in both ſexes accompany the principal veins on the bladder and at the bottom, and right and left ſide, paſs into the glands ſurrounding the internal iliac artery and vein; but previous to this they frequently paſs into ſmall glands ſituated on the ſides of the bladder itſelf (Cruikſhank, p. 158.).

(407) Phyſicians have lately been very much employed in detecting the conſtituent parts of the *calculus*, and have beſtowed much pains in examining the human urine. It is not my buſineſs to relate their experiments, or to dwell on their ſeveral concluſions; therefore, I ſhall only remark, that it is almoſt always acid, even in health, and that it is this, ſuperabundant acid, that keeps the cal-

careous

Of the Genitals of Men.

The *Genitals* of men are
1. The *Teſticles*, and *Scrotum*,
2. The *Spermatic Veſſels*, and
3. The *Penis*.

1. The *Teſtes* are two ſmall bodies (408) of an oval form; ſituated in adults, without the *abdomen* naturally, under the *penis*, in a peculiar bag, called the *Scrotum:* but in *foetus*, and ſometimes even in adults, they are not in the *ſcrotum*, but in the cavity of the abdo-

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careous phoſphat, or phoſphorated lime, diſſolved; that the human *calculus* is chiefly compoſed of phoſphorated lime, and that whatever rids the urine of the exceſs of acid, tends to generate the ſtone, by cauſing a precipitation of the phoſphorated lime (Conſult Scheele's Eſſays.).

The Urine evacuated immediately after drinking is called *Urina Potus*; that which is not evacuated till ſeveral hours after eating, is called *Urina Sanguinis*. The former depoſits no ſediment.

The ſubſtances ſeparated from the *urina ſanguinis* by ſpontaneous decompoſition, are, 1. a gelatinous ſubſtance, or *mucus*, which forms the firſt ſediment: 2. a ſaline earthy ſubſtance: 3. a colouring ſubſtance; and 4. ſalts of different kinds (*Hiſt. de la Société Roy. de Medicine.* 1779.).

As the depoſition from the *urina ſanguinis* takes place as the heat is diminiſhed, ſo by encreaſing the heat, the ſediment may be re-diſſolved.

(408) If ever there be more teſticles than two, it is certainly very uncommon. Nor does it ſeem unlikely that in thoſe perſons, who have been ſaid to have had three teſticles, the *epididymis* having become leſs firmly connected with one of the teſticles, and ſeparated in ſome manner from it, created ſuch a belief.

men (409). Nevertheleſs, they deſcend by degrees into the groins, and thence into the *ſcrotum* (410).

The *Involucra* of the teſticles are

1. The *Scrotum*, which is compoſed of *epidermis*, ſkin beſet with hair, and cellular texture, which is thick, and having numerous blood-veſſels, and being cloſely connected with the ſkin, including each teſticle apart; and although it has no muſcular fibres at all,

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(409) The teſticles do not always deſcend from the *abdomen* into the *ſcrotum* together. Sometimes one and ſometimes both continue in the *abdomen* till a perſon is much advanced in years, and ſometimes they do not deſcend at all in the whole courſe of one's life-time (Haller upon Boerhaave's *Inſtit. Med.* § 641.).

(410) The *Teſtes* may be conſidered as abdominal *viſcera* till the approach of birth. It is very hard to ſay at what period the *teſtes* begin to be moved towards their deſtined place in the *ſcrotum*. "According to the obſervations which I have made, ſays Mr. Hunter, it ſeems to happen ſooner in ſome inſtances than in others, but generally about the eighth month. In the ſeventh month I have commonly found the *teſtis* in the *abdomen*, and in the ninth I have as commonly found it in the upper part of the *ſcrotum* (Obſ. on the An. Oecon. p. 9.)." See the Lond. Med. Journ. Vol. 6. p. 309. When in the *abdomen*, it is connected with the *ſcrotum* by a ligament, which becauſe it ſeems to direct the courſe of the *teſtis*, is called by Mr. Hunter *Gubernaculum Teſtis*. The form of this ligament is pyramidal; its baſe being fixed to the lower end of the teſtis and epididymis, and its apex being loſt in the cellular membrane of the *ſcrotum*. Its upper part is within the *abdomen*, before the *pſoas* muſcle, covered with *peritoneum*, except poſteriorly, where it is connected with the *pſoas* by the reflected *peritoneum*. After the *teſtis* has gotten through the tendon of the external oblique muſcle, and deſcended entirely into the *ſcrotum*, its ligament is ſtill connected with it, and lying under it (Hunter.).

yet it is called the *Dartos*, or *Muſcular Coat* (411). As the Dartos ſurrounds each teſticle ſeparately, the *ſcrotum* is divided into two oval cavities, which, where they join together inferiorly, form a rough eminence called the *Raphe*.

2. The *Cremaſter Muſcle*, which entirely covers each teſticle, being chiefly formed of the fibres of the *obliqui interni abdominis*. The *Uſe* of the *Cremaſter* is to compreſs, to elevate, and to evacuate the teſticle (412).

3. The *Tunica Vaginalis Teſtis*, compoſed of cellular texture, is eaſily diſtenſible by air. It is a continuation of *peritoneum*. It looſely inveſts the teſticle, and is threefold.

The *outermoſt*, which covers both teſticle and ſpermatic veſſels, is compoſed of the external cellular texture of the *peritoneum*.

The *Second* inveſts each ſpermatic veſſel ſeparately.

The *Third* involves each teſticle ſeparately. This ariſes from the *peritoneum*, and covers the ſpermatic veſſels: it is ſo cloſely connected with them at the beginning of the teſticles, that in a natural ſtate, air cannot be blown into the teſticle. Beſides, it affords a larger covering, which is looſely attached to the teſticle (413).

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(411) The *Dartos* is deſcribed as a muſcle by Douglas (*Myotom. Comp. Cap.* II.), Winſlow (*Expoſ. Anat.*), and others; but Haller ſays the *ſcrotum* contains nothing muſcular in it; that the *dartos* is mere cellular membrane, in which, however, there is an elaſticity, as may be ſeen upon the application of cold, &c. (*Pr. Lin. Phyſ.* § 808.). Albinus and Heiſter, were of the ſame opinion.

(412) See the Myology.

The *Tunica Albuginea*, or inmoſt coat of the teſticles, is ſtrong, white, denſe, and immediately covering them.

We may alſo notice in the *teſtes*,

1. *Two Extremities*, of which that which is turned upwards, and ſomewhat outwards is pointed; but the inferior is obtuſe.

2. *Two Margins*, the *Anterior* and the *Poſterior*, upon which the *Epidermis* is placed.

The *Veſſels* of the Teſticles are

1. The *Spermatic Artery*, which ariſes on each ſide from the *aorta*, above or below the renal arteries, and ſometimes from the renal artery itſelf (414): it deſcends outwards, before

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(413) Mr. Cruickſhank could not coagulate the fluid of this ſac, nor that of the ventricles of the brain, nor the *liquor pericardii* in a heat below 140° or 160° of Farenheit.

(414) The Antients called the Spermatic Arteries *Vaſa Praeparantia*: and Dr. Monro imagines that the *ſemen* begins to be formed in them (*De Teſtibus*, &c. p. 11.).

Mr. Hunter ſays the Spermatic Artery ariſes often from the emulgent, or renal artery, and eſpecially on the right ſide of the body, which he imagines to depend upon the greater diſtance between the *aörta* and the right, than the left teſticle. This ſame anatomiſt remarks that the Spermatic Artery, ſometimes ariſes from the phrenic artery, or that of the *Capſula Renalis* (Obſerv. on certain Parts of the An. Oecon. p. 3.).——Mr. Hunter alſo ſays that the teſticle receives an artery, which is often as big as the ſpermatic from the hypogaſtric artery. The ſpermatic arteries are very ſmall at their origin, conſidering the *viſcera* to which they go; and what is ſtill more ſingular, their before the *pſoas magnus* muſcle to the abdominal ring, where it joins the ſpermatic vein the ſpermatic duct, and a large quantity of cellular texture, and becomes a round cord, called the *Spermatic Cord.* This cord enters the groins through the abdominal rings, and deſcends into the *ſcrotum* to the teſticles.

The Arteries that go to the external tunics of the teſticles, ariſe from the coeliac artery: thoſe going to the *ſcrotum* come from the crural and external pudendal arteries.

2. The *Spermatic Veins:* the *Right* returning its blood into the *vena cava*, and the *Left* returning it into one or both renal veins. They ariſe by many ſmall branches from the teſticles themſelves, and come together into trunks, which trunks are bent in a ſerpentine manner: they accompany the teſticles into the abdomen, and form a *plexus* there, called *Corpus Pampiniforme*, which ſurrounds the ſpermatic artery (415).

The

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their diameter encreaſes as they give off branches, and approach nearer to the teſticle. Beſides the motion of the blood is retarded by this fabric, and a larger quantity of blood is always found in theſe than in any other arteries after death (Monro *De Teſtibus*, &c. p. 10. 11.).

Why the *teſtes* have their blood-veſſels from ſuch diſtant origins, is clear from this, that the primitive ſituation of the teſticles is immediately below the kidneys, and that the great length of the ſpermatic veſſels is intended by Nature to render the circulation in them ſlow (Hunter An. Oecon. p. 13.).

(415) The Spermatic Veins have valves, placed in different parts, in no determinate number. In ſome there is only

The Veins of the external integuments of the teſticles have the ſame name as the arteries: they pour their blood into the *vena ſaphoena*, and the crural vein.

3. There are *Lymphatic Veſſels* as well in the *teſtes* as in the ſpermatic cord (416).

4. The *Nerves* of the teſticles are very numerous. They penetrate the inmoſt ſubſtance of the teſticles. They ariſe from the renal *plexus*. The teſticles have nerves alſo coming from the trunk of the intercoſtal nerve, from the great meſenteric *plexus*, the

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only one or two, in others there are five or ſix pair. Monro could not find any valves at all in the ſpermatic veins of five women, which he diſſected on purpoſe; three of whom were pregnant. He ſays, however, that this fact agrees with theory; for the ſpermatic veins of women do not paſs through the abdominal rings, and, therefore, are not liable to ſuffer from the action of the abdominal muſcles. He ſays alſo, that valves would be an impediment to the menſtrual flux; and conjectures that their defect may be accounted a chief cauſe of the *Menſes* (*De Teſtibus, &c. p.* 14. 15.).

Beſides the Veins deſcribed in the text, there is one coming from the internal iliac, and running upwards to the teſticle along with the inferior ſpermatic artery (Hunter Obſ. on Certain Parts, &c.).

Some anatomiſts imagined that the ſpermatic artery and vein communicate with each other by means of an *anaſtomoſis*, before they come to the teſtis. But we know nothing of ſuch *anaſtomoſis*, though the celebrated Boerhaave ſhall have deſcribed it (See *Martinii Comment. in Tab. Euſt.* XII.).

(416) Mr. Cruikſhank diſtinguiſhes the abſorbents of the teſticles into four claſſes; thoſe of the coats, thoſe of the body of each teſticle, thoſe of the *rete teſtis*, and thoſe of the epididymis (p. 141.).

lumbar nerves, and the meſocolic *plexus:* all theſe are united with the ſpermatic cord, and go with it to the teſticle (417). The *nerves of the ſcrotum*, and the cremaſter muſcle come from the ſecond, third, and fourth lumbar nerves (418).

The *Fabric of the Teſtes.* They are compoſed of ſmall veſſels, bent in a ſerpentine direction, ariſing from the ſpermatic artery, and convoluted into little heaps, which are ſeparated one from another by cellular partitions (419). In each partition there is a duct receiving *ſemen*

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(417) The great ſympathy between the teſticle and the alimentary canal is eaſily accounted for by conſidering that the nerves of the teſticle come from the *plexus* of the intercoſtal nerve. In an inflammation of the teſticles, the pain is dull and oppreſſive, and the pulſe is not quick and hard as in moſt inflammations, but contracted as in *enteritis.*

(418) Theſe nerves were ſuppoſed to go to the teſticle; but Mr. Hunter agrees with Prof. Leber, that they go only to the exterior coverings and the *ſcrotum.*

(419) The colour of the teſticle is yellow; for its white appearance depends upon the *tunica albuginea*, which adheres cloſely to it.—The ſmall veſſels, mentioned in the text, are cylindrical, and not conical. Their diameter is ſaid by Monro to be the $\frac{1}{200}$th part of an inch *(De Teſtibus, &c.).*

Haller, who injected mercury into theſe veſſels, through the *vas deferens* and *epididymis*, ſaw ſome ſtraight veſſels *(vaſa recta)* coming out of the ſuperior part of the *teſtis:* and, within the *tunica albuginea*, he ſaw theſe veſſels inoſculated one with another, conſtituting what he calls the *rete vaſculoſum teſtis* (Philoſ. Tranſ. No. 494. § 12. or the *Tom.* II. *Tab.* I. *Fig.* I. of his *Opera Min.).* Haller alſo called the veſſels which paſs through the *tunica albuginea*, *Vaſa Efferentia.* They are ten, twenty, or *ſemen* from the ſmall veſſels: and all the ducts conſtitute a net, which is attached to the *tunica albuginea.* From this net-work, twenty or more veſſels ariſe, all which are variouſly contorted, and being reflected, aſcend to the poſterior margin of the *teſtes*; and in this place, they unite into one common duct, on the external ſurface of the *teſtis.* This duct is variouſly complicated at the poſterior margin of the *teſtis*, and bent into ſerpentine windings, all which, covered by the *tunica albuginea*, form that body, which by anatomiſts is technically called the *Epididymis.*

We muſt obſerve of the *Epididymis*, its thick head, which is convex, and ſituated ſuperiorly; and its extremity, which is thin, and rather flat, and ſituated inferiorly. The

or thirty in number, and forming cones, by being convoluted, they conſtitute the head of the *epididymis*: ſo that the head of the *epididymis* is formed of as many cones as there are *vaſa efferentia*: the veſſels having formed theſe cones, unite at length into one veſſel, which conſtitutes the reſt of the *epididymis.* That the *epididymis*, its head excepted, is formed of one veſſel coiled up, is plain from this fact; that if any part of the *epididymis*, except its head, burſt, or any ſingle veſſel be tied whilſt mercury flows into it, every attempt to force the mercury beyond the rupture, or the ligature, will be vain (Monro *De Teſtibus*, &c. p. 31.).

Monro ſays, " All things being fully conſidered, it ſeems very likely that a teſticle is a congeries of cylindrical, ſerpentine ducts, the apices, or beginnings of which are blind *(cæca)*, and that very ſmall arteries are diſtributed among them, depoſiting *ſemen* into their cavities, nearly in the ſame manner as the branches of the meſeraic artery diſcharge lymph into the cavity of the inteſtines (p. 42.)."

Epididymis adheres to the teſticle by its two extremities; for its middle part is free, forming a bag, to which the *tunica vaginalis* is attached.

This duct, of which the *epididymis* is formed, gradually grows larger, and becomes leſs convoluted. It is covered, together with the ſpermatic veſſels by the *tunica vaginalis*, and aſcends to the abdominal ring in the groins, under the name of *Vas Deferens*. It paſſes through this ring, and deſcends, without the *peritoneum*, in the *pelvis* as far as the neck of the bladder; where each, on its own ſide, is inſerted into the *veſiculae ſpermaticae*, which are placed there (420).

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(420) The *ſemen* firſt emitted is of a bluiſh white colour, and ſimilar to what is found in the *vaſa differentia* after death; while that which follows is ſomewhat like the common *mucus* of the noſe, but leſs viſcid. The *ſemen* becomes more fluid upon expoſure to the air, particularly that firſt thrown out, which is the very reverſe of what happens to ſecretions in general. The ſmell of the *ſemen* is maukiſh, and unpleaſant, exactly reſembling that of the Spaniſh cheſnut. The taſte is at firſt inſipid; yet there is ſomewhat of pungency in it, which after ſome little time ſtimulates, and excites a degree of warmth in the mouth (This is taken from Mr. Hunter's Obſ. on the An. Oec. p. 27.). A part of it is ſpecifically heavier than water; but a part remains ſuſpended in films, or floats upon the ſurface. Fourcroy ſays it may be converted into a dry ſubſtance, eaſily friable by heat. Diſtilled in a retort, it yields phlegm, a volatile ſalt, a foetid oil, and a large quantity of earth (Monro *De Teſtibus, et Semine, &c. p.* 58.). Examined by the microſcope, it is ſaid by ſome to contain *animalcula*, which one Hammius firſt diſcovered, and afterwards

The *Spermatic Cord* is compoſed of the *vas deferens*, the ſpermatic artery and vein, lymphatic veſſels, nerves, and the *tunica vaginalis* ſurrounding the *cremaſter*.

The *Veſiculae Spermaticae* are two ſmall receptacles, of a whitiſh, ſhining colour, ad-

afterwards Lewenhoeck (*Cont. Arc. Nat.* p. 59. 60.). Theſe *animalcula* are ſeen to move determinately, and quickly, agitating their tails like ſnakes, and diſturbing the fluid in which they ſwim. Some follow, ſome meet one another, and ſome ſeparate. They move ſometimes quicker than at others, but at length they languiſh, die, and ceaſe to move at all, if you believe Valiſnerius. But the celebrated Buffon has alſo ſeen theſe *homunculi*; ſome of which are rotund, ſome oblong, and ſome ſmaller in the middle than at either end (*Hiſt. Nat. des Animaux. Cap.* 6. *exp.* 1.—46.). Even Kaaw ſays that the very ſmall human *embryo* is liker to the ſpermatic animalcum, as it is leſs advanced from the period of conception (*Imp. fac. p.* 39.): the figure alluded to by Kaaw is that of a ſphere, or oblong, with a longer or ſhorter tail, which is the more ordinary figure. In very old people, and in young children, alſo in thoſe who are much addicted to copulation, or have their *ſemen* vitiated as in *gonorrhoea*, there are few *animalcula*, or none, or that few ſickly and ſlowly moving.

Some deny that any *animalcula* can be found in the human *ſemen*.

The *ſemen* being abſorbed at puberty, produces wonderful changes in the conſtitution, the voice, a proof of the increaſed rigidity of the muſcular fibres, becomes ſtronger and more equal, hairs grow on ſeveral parts of the body, and the mind, actuated by the growth of the body, acquires new propenſities and paſſions. Proofs of this are evident in caſtrated animals. Of its effects when abſorbed into the female maſs, ſee the note on Generation (433).

The *ſemen* is abſolutely neceſſary for the fecundation of the female.

hering to the bottom of the urinary bladder, and ſeated upon the *rectum* and proſtate gland. They paſs obliquely from without inwards; ſo that their ſuperior extremities, which are thick, are placed at a diſtance from each other; but their inferior and ſmall extremities are joined together.

As to their *Fabric*, they reſemble an inteſtine variouſly contorted and folded. The external coat of theſe *veſiculae* is thick and ſpongy; the internal coat is beſet with folds and very ſmall *villi.*

Each *veſicula ſpermatica* is in general poſſeſſed of one excretory duct, covered by the proſtate gland, and perforating the beginning of the *urethra*, at its lower ſide. At the opening of theſe ducts into the *urethra*, there is a ſmall, oblong eminence in men, formed of the internal coat of the *urethra.* This eminence is broad poſteriorly, but is terminated anteriorly like the beak of a bird; hence it is called *Caput Gallinaginis.*

The *Blood-veſſels* and *Nerves* of the *veſiculae ſpermaticae* come from the contiguous parts.

The *Lymphatic Veſſels* of the ſeminal glands open into lymphatic glands placed about the loins.

The *Uſe of the Teſticles* is to ſecrete ſperm from the blood.

The *Uſe of the Vas Deferens* is to contain the ſperm ſecreted from the blood, and to carry it into the ſpermatic veſicles.

The *Uſe of the Spermatic Veſicles* is to retain the *ſemen*, to abſorb a part of it into the common maſs of blood, and to expel it, at a proper time, into the *urethra* (421).

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(421) The *Semen* has hitherto been ſuppoſed to paſs into the *veſiculae ſeminales* from the *vaſa deferentia*, by a kind of retrograde motion, like that by which bile paſſes into the gall-bladder; but Mr. Hunter objects to this, for various reaſons, among which the following are the principal.

1. Becauſe *ſemen* emitted from a living body differs from the *mucus* of the *veſiculae ſeminales*, both in colour and ſmell.

2. Becauſe *ſemen* can be ejected immediately after the *veſiculae* are emptied of their *mucus*.

3. Becauſe in perſons who have been caſtrated on one ſide, and cohabited with women afterwards, the *veſiculae ſeminales* of the ſide, from which the teſticle was taken, are as large, and contain as much as thoſe of the oppoſite ſide, which could never happen if the *veſiculae* contained *ſemen*; for coition muſt empty them, and they can never be poſſibly filled with the ſame again.

4. Becauſe the *Veſiculae* are as full in the emaciated after a lingering illneſs, and in the aged and decrepid, as in the healthy and robuſt, and young. Which could not be, if they contained *ſemen*.

5. Becauſe the *Vas Deferens* contains not *ſemen*: for *ſemen* is only ſecreted, when certain affections of the mind ſtimulate the teſticles.

Mr. Hunter infers from his experiments—"That the bags, called *veſiculae ſeminales*, are not ſeminal reſervoirs, but glands ſecreting a peculiar *mucus*, and that the bulb of the *urethra* is, properly ſpeaking, the receptacle of the *ſemen*, in which it is accumulated previous to ejection." Again, he ſays—"Although it ſeems to have been proved that the *veſiculae* do not contain the *ſemen*, I have not been able to aſcertain their particular uſe; we may however be allowed, upon the whole, to conclude that they are, together with other parts, ſubſervient to the purpoſes of generation (Obſ. on certain Parts, &c.)."

The *Virile Member*, or *Penis*, is a cylindrical body, ſeated above the *ſcrotum*, and extended from the region of the pubis. Its ſuperior ſurface, which is flat, is called the *Dorſum Penis.*

In adults, the length of the penis is generally ſix inches; the thickneſs is in proportion to the length.

The *Penis* is divided into its
Root,
Body, and
Head: which laſt is called *Glans Penis.*

The *Penis conſiſts* of the *Urethra* and the two *Corpora Cavernoſa*, which are covered by the common integuments of the body.

The *Urethra* is a membranous canal, running from the neck of the urinary bladder, inferiorly through the middle of the cavernous bodies, placed on each ſide, as far as the extremity of the *penis*, and ending there by a longitudinal orifice in the anterior part of the *glans*.

The *Figure* of the *urethra*, generally ſpeaking, is cylindrical, yet it has three manifeſt dilatations; the firſt of which is conſpicuous in the proſtate gland, near the *caput gallinaginis*; the ſecond is in the bulb, and the third is at the beginning of the *glans penis*.

It is compoſed of two tunics; the external is a production of the nervous coat of the bladder; the internal ariſes from the *epidermis*. It is here and there perforated with numerous excretory ducts of mucous glands.

Between both theſe coats, there is a cellular texture, which is adapted to become tumid, whenever blood or air is forced into it; it is called the *Corpus Cavernoſum Urethrae.* This cavernous body ariſes directly under the proſtate gland, and accompanies the *urethra* throughout the whole *penis*; firſt, at the inferior part of the *urethra*, and afterwards at the ſuperior and lateral part. Poſteriorly at its origin, there is a longitudinal dilatation, which is called the *Bulb of the Urethra.*

Immediately behind the bulb of the *urethra*, there is the longitudinal eminence, which we before called *Caput Gallinaginis*; this *caput gallinaginis* covers the two orifices of the ſpermatic veſicles. About the *caput gallinaginis* there are ten or twelve orifices, ariſing from the excretory ducts of the proſtate gland. Anteriorly, at the end of the *penis*, the ſpongy body of the *urethra* covered by its two tunics, is inflected outwards and backwards, in which manner it forms the *Glans Penis.*

The *Glans Penis* is compoſed of the *epidermis*, the *corpus ſpongioſum*, and the internal coat of the *urethra*, which now forms the external coat of the *glans*, and is, in this part replete with nerves (422).

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(422) The *corpus ſpongioſum* and *glans* are formed of convoluted veins, and are not ſpongy or cellular.

Albinus macerated the *glans penis* in water till the cuticle and reticular body came off; and by a proper injection, In Figure, it reſembles an obtuſe cone, the apex of which, at the anterior part of the *urethra*, is perforated by an orifice; the baſe, which is ſomewhat excavated, is placed poſteriorly, and receives the *corpora ſpongioſa penis*. Externally, it has a round prominent margin, called *Corona Glandis*. The narrow, and contracted part placed under the *corona*, is called the *Neck of the Glans*; this neck is beſet with numerous glands, ſecreting a mucous liquid.

The two Cavernous, or *Spongy Bodies of the Urethra* ariſe on each ſide, internally from the

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jection, was able to demonſtrate *villi*, like thoſe of the lips (*Acad. An. L.* III. *Cap.* 9.).

Of the Nerves of the *glans penis*, it is worth while to remark, that there are two orders of nerves diſtributed to it; the one poſſeſſing common ſenſation, the other the peculiar ſenſe of the *glans*. To explain this, it need only be obſerved now, as it was in the Neurology, that the organs of ſenſe have particular nerves, which act differently from thoſe producing common ſenſation, and from one another; that a nerve being ſo affected as to communicate ſenſation, in whatever part of the nerve an impreſſion is made, always gives the ſame ſenſation as if it were affected at the common ſeat of its ſenſation. This doctrine is advanced by Mr. Hunter, and illuſtrated with the following very appoſite caſe:—"I knew a gentleman who had the nerves which go to the glans penis completely deſtroyed by mortification, almoſt as high as the union of the penis with the pubes; and at the edge of the old ſkin, at the root of the penis, where the nerves terminated, was the peculiar ſenſation of the glans penis, and the ſenſation of the glans itſelf was now only common ſenſation; therefore the glans has, probably, different nerves, and thoſe for common ſenſation may come through the body of the penis to the glans (Obſ. on certain parts of the An. Oecon. p. 216.)."

prominence of the *os iſchii*, and that part of the *os pubis*, which adheres to the *os iſchii*, where they are connected by firm and denſe cellular texture. From this part they paſs inwards and forwards to the *urethra*, which they ſurround immediately before the bulb, and being united, they go on forwards and end in the *glans* by an obtuſe point.

The ſpongy bodies reſemble two cylinders cloſely applied to each other; they have inferiorly between them a furrow, throughout their whole length, in which the *urethra* is placed, and ſuperiorly a leſs furrow, in which veſſels are lodged.

Their *Fabric* conſiſts of a ſpongy cellular texture, which may be diſtended by the influx of blood, or air (423). They are united together

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(423) The cells of theſe bodies, ſays Mr. Hunter, are muſcular, although no ſuch appearance is to be obſerved in men; for the *penis* in erection is not at all times equally diſtended; the *penis* in a cold day is not ſo large in erection as in a warm one, which probably ariſes from a kind of ſpaſm that could not act upon it, if it were not muſcular (p. 39. of the *Obſ.* above cited.).

The erection of the *penis*, has been variouſly accounted for. That it ariſes from an unuſual accumulation of arterial blood in the cells of the *penis* was long ago proved by Swammerdam and De Graaf, who tied the *penis* of a dog during coition, and cut it off between the ligature and its root; upon which, the blood flowed out in large quantity, and the *penis* became flaccid, and of leſs dimenſions. The difficulty is, to tell what arreſts the blood in the cells; why it is not returned by the veins as faſt ther longitudinally by a membranous partition, in which, in ſome places, but chiefly anteriorly, there are orifices, through which there is a free paſſage from the right *corpus ſpongioſum* to the left.

Externally they are clothed with a tendinous tunic. Beſides which, they have a very ſtrong ligament poſteriorly, ariſing from the *ſymphyſis* of the *oſſa pubis*, and implanted in the *dorſum penis*, where the two bodies now mentioned are joined together. Anteriorly, this ligament vaniſhes in a ſubtile cellular texture, covering the cavernous bodies. Externally, the *corpora cavernoſa* are covered with ſkin and *epidermis*, which paſs forwards over the *glans*, and are revolved backwards and in-

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as it is brought by the arteries?—Now, no mechanical preſſure whatſoever, applied to the body of the *penis*, can force the blood into the veins (Hunter's Obſ. p. 40.). It can however be forced out of the *corpus ſpongioſum* of the *urethra*, and the *glans*, by preſſure; but theſe are never ſo much diſtended as the body of the *penis*.—The erection of the *penis* is aſcribed by Dr. Whytt to an oſcillatory motion of the arteries opening into the cells of the penis; which oſcillatory motion, he imagined, depends upon the recalled idea of laſcivious objects; hence the arteries are enabled to bring more blood, than the veins can return, in the ſame given time (*Of the* Vital *and other* Involuntary Motions, Sect. VI. § 4.). Du Verney (*Act. Petropolit. Tom.* II.) and Haller (*Pr. Lin. Phyſ.* § 839.) attribute the retention of the blood in the *penis* to certain nervous filaments ſurrounding the veins; which nerves, they ſay, act in conſequence of the mind. Dr. Whytt however juſtly remarks that we know not how the nerves can be ſo drawn as, like a ligature, to ſtraiten the veſſels which they encompaſs. See Albinus's *Annot. Acad. Lib.* II. *Cap.* XVIII.

wards towards themſelves. This doubling of the ſkin, called the *Fore-ſkin*, in which there is cellular membrane, may be drawn over the glans. Inferiorly, the prepuce is connected to the cellular texture of the *penis*, even at the orifice of the *urethra*, by means of a double triangular ligament, called the *Ligament of the Prepuce*.

The *Glands* of the *Penis* are

1. The *Proſtate Gland*, which is firm and denſe, ſituated between the neck of the bladder, and the bulb of the *urethra*; it ſurrounds the *urethra* exactly, not only inferiorly and laterally, but alſo ſuperiorly. Its Figure is like that of a heart, for it is thick and broad poſteriorly, and thin and narrow anteriorly (424).

Its *Internal Fabric* is ſingular, and not yet well underſtood; it has ten or twelve excretory ducts, opening about the *caput gallinaginis*, and depoſiting a whitiſh, thick, ſubviſcid liquid into the *urethra*. Externally it is covered by a cellular tunic, to which many of the muſcular fibres of the urinary bladder are fixed.

2. The *Glandulae Cowperianae*, which are ſmall, hemiſpherical, and compound. One

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(424) Mr. Hunter ſuppoſes that the *Veſiculae Seminales* anſwer nearly the ſame purpoſes as the proſtate gland; becauſe in the bull, the buck, &c. where there is no proſtate gland, there the coats of the *veſiculae* are much thicker and more glandular (Obſ. &c. p. 39.). See *Veſiculae Seminales*.

of them is ſituated on both ſides of the *urethra*, without the *corpus ſpongioſum* and *acceleratores* muſcles, between the bulb and the proſtate. Each has an excretory duct, through which a mucous liquor is evacuated upon the internal ſurface of the *urethra*, for its defence. Whether there be other glands belonging to this part, as ſome authors ſay, it is uncertain (425).

The *Veſſels* of the *Penis* are

The *Common Pudendal*, or *Inferior Hemorrhoidal Artery*, which ariſes from the iliac artery, and is divided into two branches, of which the internal goes to the bulb of the *urethra* and the proſtate; the external is ſubdivided into two others, one of which runs through the middle of the whole *corpus cavernoſum*, the other creeps along the back of the *penis*, and is terminated by its ſmall branches in the *corpora cavernoſa* and ſkin.

Moreover, there are other branches coming from the coeliac and femoral artery, and vaniſhing in the ſkin.

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(425) Theſe glands, of which the excretory ducts are called *Lacunae*, ſecrete a very large quantity of a viſcid mucus, which is ſalt to the taſte, and ſerves perhaps to lubricate the *urethra*, it being evacuated only in the vigour for copulation (Hunter *Ibid.* p. 39.). Haller ſays the liquor of the proſtate gland is white, thick, and coagulable upon the admixture of alkohol, and imagines that the bulk of the *ſemen* is enlarged by it, and of conſequence, more eaſily ejected, but its real uſe is not known (Marherr, *Prael. in Boerh. Inſtit. Med.* § DCLIII.).

The *Veins*, which go in the ſame manner as the arteries, lead into the iliac vein, the largeſt of them, lying upon the back of the *penis*, is called *Vena Penis*; this terminates above the proſtate in the hemorrhoidal vein, and this laſtly in the *cava*.

The *Lymphatic Veſſels*, which are ſeated under the ſkin, paſs into the inguinal glands (426).

The *Nerves* ariſe from the large crural and the laſt ſacral nerve. But ſome branches from the inferior meſenteric plexus paſs alſo into the *urethra*.

The *Muſcles* of the *Penis* are deſcribed in the *Myology*.

The *Uſe of the Urethra* is to evacuate the urine, and, in adults, the ſperm, together

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(426) "The ſuperficial abſorbents of the *penis* ariſe from the prepuce in three diviſions; one on the right ſide of the *fraenum*, another on the left, and a third directly on the middle of the ſuperior ſide. Thoſe from the under ſide make a ſemicircular turn, from the under to the upper-ſide of the *penis*, whilſt that on the ſuperior part of the prepuce runs on the middle of the dorſum penis, exactly in the direction of the ſymphyſis pubis. At a little diſtance from the ſymphyſis, the three diviſions unite into one common trunk, which almoſt immediately ſeparates again into two, one going to the right groin, accompanies the veins going to the inguinal vein, and terminates near it in thoſe inguinal glands which are neareſt the ſymphyſis pubis. The other trunk goes to the left groin, and terminates exactly in the ſame manner as the former."—"The deep-ſeated ones accompany the arteries, and paſs with them on the inſide of the tuberoſities of the iſchia, or under the angle of the pubis (Cruikſhank, p. 152.)."

with the liquor of the proſtate. The *Uſe* of the *Corpora Cavernoſa* is to expand and ſtiffen the *penis* and *urethra.*

Of the Genitals of Women.

The Parts of Women, deſtined for generation, are divided into *External* and *Internal.*

To the *External* Parts are referred

1. The *Labia Pudendorum majora.*
2. The *Clitoris.*
3. The *Nymphae*, or *Labia minora.*
4. The *Orifice of the Urethra.*
5. The *Orifice of the Vagina Uteri.*

1. The *Labia Pudendorum Majora* are two Lips or Lobes of a ſoft conſiſtence, which ariſe from the *ſymphiſis* of the *pubis*, and end in the *perinaeum.* Somewhat above their beginning, there is a ſoft prominent region, poſſeſſed of much fat, and, in adults, covered with ſhort, criſp hair; it is called the *Mons Veneris.*

Theſe *Labia* are again joined together at their extremity by means of a ſtrong ligament, which is very conſpicuous in infants and adults; but it is very lax, and ſometimes wholly torn through, in women that have frequently borne children. It is the ſpace between this ligament and the orifice of the *anus*, that is called the *Perinaeum.*

The Fabric of the *labia* conſiſts of *epidermis*, *cutis*, and cellular ſubſtance filled with fat, endowed with veſſels, and prone to tumify. Its internal ſurface is red, and it has numerous mucous and ſebaceous glands; its external ſurface is of the ſame colour as the ſkin, and is adorned with very many criſp hairs.

2. The *Clitoris*, like the *penis* of men, is compoſed of two cavernous bodies, which likewiſe ariſe from the *oſſa iſchii*, and are united in a ſimilar manner; but anteriorly they have no orifice, becauſe the *urethra* is not encompaſſed by them in women as in men.

The *Clitoris* is naturally ſmall and ſhort, but it is very ſenſible, having numerous nerves. Its ſituation is in the ſuperior angle of the *Labia Pudendorum Majora*.

As the *Penis* of man, ſo likewiſe the *Clitoris* of woman can be diſtended and erected. Beſides, the clitoris hath veſſels, nerves, *muſculi levatores*, a ligament continued from the ſymphyſis of the *oſſa pubis*, and inſerted into it, and a fore-ſkin capable of being drawn backwards.

3. The *Nymphae*, or *Labia Minora* repreſent two membranous wings, continued from the fore-ſkin of the *clitoris*, and inſerted by a broad extremity into the orifice of the *vagina uteri*. The *Nymphae* are naturally ſmall; yet they ſometimes increaſe ſo much, as to hang down a conſiderable way.

As to their Fabric, they are compoſed, as is already obſerved, of the fore-ſkin of the *clitoris*, which contains in it cellular texture diſpoſed to tumefaction. It hath very many ſebaceous glands on both ſides. The *Nymphae* are exquiſitely ſenſible, having numerous nerves, which, like the blood-veſſels, come from adjacent parts.

Their *Uſe*. They create pleaſure, and direct the urine flowing between them, out of the *urethra*, in ſuch a manner as to prevent its wetting the thighs.

4. The *Orifice of the Urethra* is ſituated immediately under the *clitoris*, at the beginning of the *nymphae*. The urethra itſelf is larger by far than in men; but it is much ſhorter, being only two inches long. Its fabric, in other reſpects, is like that of the urethra in men. Its orifice is triangular, and is beſet with large mucous glands.

5. The *Orifice of the Vagina* is under that of the *urethra*. In infants it is cloſed by a ſemilunar membrane, which ariſes from the membrane of the *vagina*, and the *epidermis*, and is called the *Hymen*. When this membrane is lacerated by attrition, there remain the *Carunculae Myrtiformes*, as they are called, which are two or four in number.

To the *Internal Genitals* of Woman are referred

1. The *Vagina*.
2. The *Uterus* and its *Ligaments*.
3. The *Fallopian Tubes*.
4. The *Ovaria*.

1. The *Vagina* is a membranous canal, that ariſes from the orifice already mentioned, un-

der the *urethra*; paſſes ſomewhat backwards and upwards, and is attached, on all ſides, to the orifice of the *uterus*. It is capable of great extenſion. It is narrow at its beginning, and very large at its end; being in length about ſix or ſeven inches.

Its *Fabric* is membranous; and it is compoſed of

1. A very thin, ſoft *epidermis*, and a thick, white, nervous membrane: both which form many tranſverſe and oblique folds on the inſide of the *vagina*.

2. Numerous *Papillae*, with very ſenſible nerves, that come from the ſacral nerve.

3. Muſcular Fibres, which go from the bottom of the *clitoris*, and are inſerted into the muſcles of the *anus*, ſo that they ſurround the orifice of the *vagina*, like a *ſphincter*.

Moreover, there are many mucous *lacunae*, through which a *mucus* is poured every way into the *vagina*.

The *Veſſels* around the whole circumference of the *vagina*, form a kind of net: the *Arteries* ariſe from the common pudendal; and the *Veins* end in the external haemorrhoidal.

2. The *Uterus* is a hollow receptacle, endowed with muſcular fibres and veſſels, ſituated in the hollow of the *pelvis*, between the urinary bladder and the *rectum*.

It reſembles in figure an oblong flagon, ſomewhat flattened; the inferior part of which is narrow, and called the *Neck*; the wider part the *Body*; and the ſuperior and convex part the *Fundus Uteri*.

We may obſerve in the *uterus*

1. The *Neck*, which is internally hollow, having many folds, and, its middle, a tranſverſe chink leading into the cavity of the *uterus*, called the *Orifice of the Uterus* (427).

2. The triangular cavity of its body, and the orifice in each angle: the inferior forming the chink of the *os uteri*, and the two ſuperior, one of which is on each ſide, the ſmall orifices of the Fallopian tubes. In the outſide of the *uterus* we remark its two convex *ſurfaces*, one of which is *anterior*, and the other *poſterior*; and the acute *margin* on both ſides, where the ſurfaces before mentioned join together.

The *Uterus* is *compoſed* of denſe cellular texture, hard indeed, but ſpongy, having flat and round muſcular fibres, eſpecially in its *fundus* and neck. In the neck and orifice of the *uterus*, there are numerous mucous glands, and ſmall ſpherical diaphanous veſicles, which veſicles were falſely declared by Naboth to be the *ovula* of the female. The cavity of the *uterus* is lined with a thin membrane, which is a continuation of the *epidermis*, forming *plicae* in the neck of the womb. The *fundus* and lateral parts of the womb, except only the anterior and poſterior ſurface, are covered externally by *peritoneum.* But the *peritoneum* is broader than the *uterus*, on each ſide, where its poſterior *lamina* unites with the anterior, to form a broad fold, which being expanded on the ſides of the *pelvis*, as far as its veſſels, is known by the name of the *Broad Ligaments of the Womb.* Between the two *laminae* of the broad ligaments, there is cellular membrane, and many veſſels and nerves. Beſides, the Fallopian tubes, which will be deſcribed in the proper place, are included in theſe ligaments. That part of the ligaments between the tubes and the *ovarium*, is called, from the figure it repreſents, *Alae Veſpertilionum.*

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(427) It is alſo called *Os Tincae*, and *Os Internum Uteri*. Haller obſerves that this tranſverſe orifice in virgins is only three lines broad; in women that have borne children from five to eight lines broad; and in pregnant women, two, three, or four inches broad (*El. Phyſ. T.* VII. *p.* 55.).

The *Round Ligaments of the uterus* ariſe on both ſides from the ſides of the *uterus*, below and before the beginning of the tubes: they then run through the abdominal ring, like the ſpermatic cord in men, and diſappear in the external *labia* of the *pudenda* (428). Properly ſpeaking, they are not ligaments, but a bundle of veſſels and fibres contained in a duplicature of the *peritoneum.* Some authors have imagined that the fibres are muſcular; but they are formed entirely of cellular membrane.

3. The *Uterine* or *Fallopian Tubes* are two canals which ariſe at the *fundus* of the womb, from the lateral angles of its cavity, near the *ligamenta rotunda:* they paſs tranſverſely, in-

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(428) Nuck formerly made mention of the canals remaining open a long time after birth, through which the *ligamenta rotunda* paſs. He called them *Diverticula* (*Adenograph. Curioſ. Cap.* X. *pag.* 133. and 134.).

cluded in two *laminae* of the *ligamenta lata*, and end with their extremities turned downwards, at the *ovaria*. The beginning of the tubes is narrow, the middle part is a little larger, but the end is contracted. They are nearly ſeven or eight inches long, each extremity being open (429).

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(429) The direction of theſe tubes is very various (Matherr, *in Boerh. Inſt. Med.* § 668.). Are theſe tubes agitated by a periſtaltic motion, beginning at the *ovaria*, and paſſing to the *uterus?* Haller ſays the motion of theſe tubes in rabbits is as quick and ſtrong as the periſtaltic motion of the inteſtines (*De Quadruped. Uter. Obſ.* 67. 70.). See (Note 433.) 5.

It may be worth while to mention the *Antra* of theſe tubes; which Roederer was inclined to believe formed in conſequence of conception. But as theſe *antra* are not, as far as I know, noticed by any other writer, I cannot refrain from tranſcribing his words.—" *Regularis omnino Antrorum figura eſt*, a ſolita tubarum fimbrias verſus dilatatione *diverſa. Tab.* IV. *Lit.* l."

" *Neque praetermittatur* rectus, *qui in figura exhibetur,*
" *vel ſaltem leviſſime inflexus Tubarum deſcenſus. Tab.* IV.
" *Serpentinae enim Tubae ex vacuo utero repere ſolent.*
" *Praeter antra et rectum deſcenſum, vix in Tubis uterorum*
" *feminarum gravidarum et puerperarum aliquid ab aliis*
" *differentiae notavi.*"

And again, (*Tab.* IV. *Lit.* l. *Nota* 6.) *pagina* 14.——
" *In hoc etiam utero, Antrum tubae dextrae apparet. Tab.* I.
" *Nota* 5. *ubi quidem ex utraque tuba adeſt: in hujus*
" *iconis utero ad ſolam tubam dextram antrum pertinet.*
" *Ad* uterum feminae octiduum puerperae *non longe a*
" *fimbria in iſtiuſmodi antrum tuba ſiniſtra prominet: dex-*
" *tra quidem ſine antro eſt, ſed verſus fimbriam ita flecti-*
" *tur, ut ultima flexura dimidium pollicem ultra reliquam*
" *tubam efferatur. Tubae* feminae, *quae mox a* maturo
" partu mortua eſt et alterius tres dies puerperae *an-*
" *tris quidem carent, ſed multum verſus fimbrias dilatantur.*
" *An ex facta conceptione iſta antra naſcuntur* (*Icones*
" *Uteri Humani. Folio. Gott.* 1759.)."

The Fabric of the tubes is like that of the *vagina:* that is, compoſed of very many blood veſſels and abſorbents, coming from contiguous parts. Perhaps they have alſo ſome muſcular fibres.

4. The *Ovaria* are two oblong bodies, flattened on each ſide, and included in the duplicature above noticed, of the *ligamenta lata* of the womb; they are ſituated about two inches from the ſides of the womb, behind, yet above the Fallopian Tubes, and are attached to theſe tubes by means of the ligament, called from its figure *Ala Veſpertilionis.* The figure of the *ovaria* is various, their length is one or two inches, and their breadth ſix or ten lines.

We obſerve of the *Ovaria*

Two Surfaces; the *Anterior* and the *Poſterior:* they are both flat, and covered by the broad ligament above-mentioned.

Two Margins: the *Superior*, which is ſtraight, and connected to the ſame ligament, and the *Inferior*, which is convex, looſely attached, and receives the veſſels.

The *Fabric* of the *Ovaria.* They conſiſt of thick, firm cellular membrane, and are ſomewhat of the ſame fabric as the *uterus.* Their external tunic comes from the *peritoneum*, and is here very thick and almoſt cartilaginous. The margin of the *ligamentum latum*, by which the *ovarium* is connected with the *uterus*, is thick and round, but not hollow, as it was ſuppoſed to be by the ancients. It is called *Ligamentum Ovarii.*

On the ſurface of each *ovarium*, under its external coat, there are ten, or even fifteen, conſpicuous veſicles, formed of a firm membrane and cellular ſubſtance; they are fixed to the *ovarium* by cellular fibres and very ſmall veſſels, and their cavity is in general full of a tranſparent, and coagulable liquor (430).

Their *Size* is different.

The *Nerves* of the *ovaria* come from the renal *plexus*.

The *Arteries* of the *uterus* ariſe from the illiac arteries, and the external hemorrhoidal artery. Some branches alſo come from the ſpermatic arteries (431).

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(430) The veſicles here mentioned were ſuppoſed by De Graaf to be real *ova*. A bloody fiſſure is always obſervable in one of the *ovaria*, after a fruitful coition, from a rupture of one, or more, of theſe veſicles during the venereal orgaſm (See what is ſaid of the *Corpora Lutea* in Note 433.).

Mr. Hunter ſays that the *ovaria* and their appendages conſtitute the female ſex. He tried by removing one of the *ovaria*, to determine how far their actions are reciprocally influenced by each other. He concludes that the *ovaria* are deſtined by Nature to produce only a certain number of young; that the number may be diminiſhed, but cannot be increaſed; and, that the conſtitution has no power of giving to one *ovarium* the power of propagating equal to two. He obſerves, however, that when one *ovarium* is taken away, the conſtitution ſeems to make the other produce its number is leſs time (Philoſ. Tranſ. Vol. 77.).

(431) As the Menſtrual Flux is a diſcharge from the arteries of the *uterus*, it may not be improper to treat of it here.—A girl when ſhe has arrived at her fourteenth year,

The *Veins* of the *uterus* are commonly analogous to the arteries; they have no valves; they

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year, ſometimes ſooner, and ſometimes later; ſooner or later according to the way of living, the temperament, the climate, &c. finds an evacuation happening from her genitals of a matter like blood. This flux is preceded by an enlargement of the *mammae*, and other ſigns of puberty. It is preceded by head-ache, dulneſs of the eyes, pain in the loins, laſſitude, colic, and ſometimes eruptions on the ſkin, and *leucorrhoea*. The matter firſt diſcharged is ſerous, but gradually becomes like blood as the flux continues; which is generally during three or four days. The quantity evacuated is various in various females, ſeldom exceeding four, five, or ſix ounces (De Haen, *Rat. Med. P.* IV.). When the flux has ceaſed, the head-ache, pain of the loins, and other ſymptoms gradually ceaſe; but the breaſts ſtill continue to enlarge, and become exuberant; and the *pubes* begins to be covered with hair: in ſhort, the whole female now acquires her moſt perfect form.

This evacuation, which happens every month, and is preceded by the ſame ſymptoms, ceaſes by degrees, and is generally altogether ſtopt about the age of fifty. It is rare indeed to find two women whoſe *menſes* flow at the ſame time. Some women never have this monthly evacuation (*Linnaei Flor. Lap. p.* 324.): and ſome have it only once in a whole year (*Halleri El. Phyſ. T.* VII. *Lib.* 28.).

As to the uſe of the *menſes*, they are generally ſaid to be for the ſake of the *foetus*; ſince they ceaſe to flow during pregnancy, unleſs there be diſeaſe (Plenck, *El. Art. Obſ.*), and ſince pregnancy never happens before the commencement of this evacuation, nor after its ceſſation, nor during any great irregularity of it.

As to the nature of the fluid diſcharged, it does not ſeem to be pure blood; for it does not coagulate. Beſides, its appearance is rather that of venous than arterial blood. It is not poiſonous.

Mr. Cruikſhank ſays, Dr. Hunter firſt diſcovered the menſtrual flux to be a diſcharge from the arteries of the *uterus*;

they terminate in the iliac and external hemorrhoidal veins. Some branches go to the ſpermatic veins.

The

uterus; he preſſed the ſubſtance of the *uterus*, and found blood oozing from it.——He knew it not to be venous, becauſe " no where are arteries more eaſily diſtinguiſhed from veins, than in this *viſcus*: the arteries are there convoluted or curling; the branches of the veins are much larger, and are not convoluted (Cruikſhank on the Abſorbent Syſtem, p. 54.)."——But if its ſource be the arteries, how comes it that it is not like arterial blood? Why are the arteries of the *uterus* convoluted? Now it may be hard to aſſign the reaſon; but their convolutions ſeem to retard the motion of the blood; and perhaps in theſe convolutions, as well as in thoſe of the ſpermatic arteries, the pulſation cannot be felt. This leads one alſo to imagine, that ſome change takes place in the blood thus accumulated; that ſomething is either added or taken away. Can its coagulable lymph be abſorbed, whilſt it remains in the convolutions? If ſo, how is the nutrition, and growth of the *foetus* to be explained???

It is fit to be aſcertained now, as nearly as may be, upon what the evacuation of the menſes, and their periodical return depends. It cannot depend upon the *Attraction of the Moon*; for women would then all menſtruate at the ſame time: whereas it is known to every one, that *menſes* flow from ſome woman or other, every hour, as well when the moon is at her apogee, as at her perigee. It cannot depend upon a *Fermentation*; for, upon this ſuppoſition, we can no more explain its periodical return, than we can its originally happening. It cannot depend upon the *Influence of Laſcivious Thoughts*, upon the *phlogoſe voluptueuſe* of Le Cat; for neither is there any proof of the exiſtence of cellular *ſinus*, in which the *menſes* could be retained, till the influence of laſcivious thoughts ſhould effect their expulſion, nor is there any proof of the putridity, which, as well as the evacuation, is aſſigned by Le Cat to the *phlogoſe voluptueuſe* (*Nouveau Syſteme ſur les menſtruations les femmes.*).

Can

The *Arteries* and *Veins* of the *ovaria* ariſe from the ſpermatic veſſels, the origin of which is the ſame in woman as man; they

Can it depend on a general *plethora*, or on a *plethora* of the *uterus* only? If it depend on a general *plethora*, how can we account for the growth of the female being always more remarkable after the appearance of the *menſes*, than before (Simpſon's Syſtem of the Womb, p. 10.)? Do we not every day know women having their *menſes*, who have no *plethora?* And, granting that Nature, while *plethora* prevails, do chooſe the *uterus* for an outlet, it cannot leſſen the *plethora*, the *menſes* flow too gradually. And, why ſhould Nature prefer the *uterus* as an outlet to every other part, as there is very little pulſation of the uterine veſſels, and they are greatly convoluted. Beſides, an eaſier outlet might certainly have been found, if Nature had in view the relief of the ſyſtem from plethora.

Laſtly, the diſcharge is too ſmall to relieve the general ſyſtem of *plethora*, if it were blood, which it is not. It does not coagulate.

Doctor Saunders, Senior Phyſician to Guy's Hoſpital, whoſe Lectures on the Theory and Practice of Phyſic were the moſt inſtructive and agreeable that I ever attended, had an opinion on this ſubject, which, I believe, originated in himſelf. As I always wrote notes from his lectures, I ſhall copy his opinion as I then wrote it (in the year 1784.).—" The *Menſes*, I take it, are a proper ſecretion. The fluid evacuated is not blood. Doctor Hunter has proved that it does not coagulate."—And again, he told us why debility does not follow the *menſes*: thus—" As ſtrength depends on coagulable lymph, it (i. e. the monthly diſcharge) cannot induce debility: for no coagulable lymph, but only red globules and ſerum are diſcharged."—To ſupport his opinion more, after telling the period at which the *menſes* commonly ceaſe, he obſerved that—" after this period the *uterus* often becomes cancerous; a proof of its being a glandular organ, and greatly favouring the idea of the *menſes* being a proper ſecretion."

form a *pampiniform* plexus, and are then implanted in the *ovaria*.

Abſorbent Veſſels are rarely ſeen; yet they have been ſeen by very famous Anatomiſts (432).

The *Nerves* of the *Uterus* come from the ſacral nerves, from the great iſchiatic nerve, and the lowermoſt meſocolic *plexus*.

As to the *Uſe* of the *Uterus*, it contains and nouriſhes the *embryo* or *foetus* (433), it retains it

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(432) Mr. Cruikſhank ſaw the lymphatics of a gravid *uterus*, which were both large and numerous. They had alſo been ſeen by Morgagni, Winſlow, and others.

(433) 1. I deſign to treat, in this place, of that faculty in animals by which they are enabled to produce beings ſimilar to themſelves. To this proceſs the names of *Conception*, *Impregnation*, and *Generation* have been given indiſcriminately, and are now-a-day uſed almoſt univerſally.

2. The more common opinion is, that during coition, the *ſemen* of the male is thrown into the *vagina* and *uterus* of the female; and, that either the *ſemen* itſelf, or the *ſpiritus genitalis*, or *aura ſeminalis* is conveyed through the Fallopian tubes to be applied by their *fimbriae* to the *ovaria*. The *ova* are thus fecundated, and afterwards detached from their veſicles, and directed by the *fimbriae* into the cavity of the tubes, and into the *uterus*.

3. The *ſemen* of the male (Note 420.) is abſolutely neceſſary to generation; but the female communicates nothing active and eſſential in the affair, as far as is yet known. To conſider the *ovaria* as glands, and the Fallopian tubes as their excretory ducts (Buffon, Hiſt. Nat.), is too ſublime and whimſical, and irreconcilable with the anatomy of the parts. Indeed, it is very probable that the celebrated Buffon, and others, miſtook an increaſed diſcharge of *mucus* for female *ſemen*, as even in fruitleſs coition there is a turgeſcence of the uterine ſyſtem, eſpecially of the *ovaria*.

4. But

it the proper time, and then expels it. The *Menſtrua* are evacuated by the *uterus*.

4. But the *ſemen* of the male is certainly not always thrown into the *uterus*, and much leſs into the Fallopian tubes, though it is generally ejected with ſome force. For the conſiſtence of the *ſemen*, and the ſtructure of the *vagina* and *uterus* muſt greatly leſſen the projecting power of the *acceleratores* muſcles (Note 285.). Beſides, the turgidity of the whole genital ſyſtem, during coition, muſt rather diminiſh and obliterate the *os internum uteri*, which however is probably never open, except during menſtruation, if then. Laſtly, there is no cavity of the unimpregnated and virgin uterus; its ſides are collapſed.

5. Some have thought that the *ſemen* paſſes into the *uterus*, and is conveyed through the tubes to the *ovaria* in conſequence of attraction. This ſuppoſition however is not feaſible; for it is by no means likely that any thing of this kind takes place in the living body. And no one can reaſonably imagine that the ſame tubes have two directly oppoſite functions; the one by which the *ſemen* of the male is conveyed to the *ovaria*, and the other by which the *ovum* is conveyed to the *uterus* (2.).

6. Hence it is clear that the *ſemen* cannot come in direct contact with the *ovaria*, and that there can be no mixture of ſeminal fluids (or organic molecules as Buffon thought) in the *uterus*.

7. Again, much of the male *ſemen* is always rejected, immediately after coition, and very little ever remains in the canal of the *uterus*.

8. Moreover it ſeems very likely that *mucus* in the *uterus* and uterine tubes was miſtaken by Ruyſch (*Theſ. Anat.* VI. *n.* 31. and *Adv. Anat. Dec.* I.) for male *ſemen*, as we are aſſured that women have conceived, whoſe *os uteri* was entirely cloſed: and the immortal Hervey could never find *ſemen* in the *uterus* of deer, which he examined through the whole months of September and October (*Exercit. De Gen. Anim.* 67. 68.).

9. Conception was accounted for in a different manner by Dr. Johnſon (A Treatiſe on Midwifery.), and a late ano-

Of the Gravid Womb, the Placenta, the Umbilical Cord, and the Foetus and its Membranes.

The *Gravid Uterus*, from the great afflux of humours, is larger every way than the virgin

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nymous writer has carried the Doctor's hypotheſis to a far greater length. This hypotheſis ſuppoſes that the *ſemen* is abſorbed into the circulating maſs of the female, exciting a material change in it; the ultimate influence of which change is determined by the operations of Nature to the *ovaria*, and that the *ovum*, already complete within the *ovaria*, is now fecundated and evolved, in a manner ſomewhat reſembling the bean, whoſe parts by age and maturation being ready to be unfolded, are ſubjected to vegetation and increaſing properties by means of their contact with the fecundating earth. See a book with this title, "Speculations on the Mode and Appearances of Impregnation in the Human Female."

10. If this account were true, we might readily believe what Averrhoes has told us of a woman who conceived in a bath, by attracting male *ſemen* ſpilled there (Brown's Vulgar Errors, Book 7. Chap. 16.).

When the *ovum* is in the *uterus*, it is nevertheleſs inviſible for ſome days (Note 438.), a mere gelatinous particle, without form. So that phyſiologiſts who have imagined that all the parts of the animal are original, complete and diſtinct in the *embryo*, and that they are only unfolded and enlarged by its increaſe, ſeem to me very much miſtaken. I imagine the parts to be formed only as they become uſeful; and if all the organs exiſted ready in the *embryo*, Why do not the effects of them alſo exiſt at the ſame time?

As to the adheſion of the *ovum* to the *uterus*, Mr. Hunter ſays that coagulable lymph is effuſed into the cavity of the *uterus*, either in conſequence of the ſtimulus of impregnation virgin *uterus*; its ſubſtance alſo is thicker, though ſpongy. For the veſſels, which are very

pregnation in the *ovarium*, or of the ſeparation of the *ovum* from it. He ſays alſo, that when the *ovum* is come into the *uterus*, it is covered with the coagulable lymph, and he conjectures that ſome of the ramifications of the veſſels of the *embryo*, contiguous to the *uterus*, lay hold on the lymph which lines it, by a ſpecies of animal attraction (On certain Parts of the Animal Oeconomy, p. 132.).

Women have commonly one child at a birth; at leaſt, if there be two, one of them, as Wriſberg obſerves (Notes on Haller's *Pr. Lin. Phyſ.* § 429.), is often deſtroyed, and comes away with the ſecundines unnoticed. So that women have twins oftener than is commonly imagined. They have ſcarcely ever more than five at once. Conſult the Philoſ. Tranſ. Vol. 77. p. 334.

The *ovum* is not always conveyed into the *uterus*. Sometimes it remains in the *ovarium*; ſometimes it ſtops in the tubes; and ſometimes it falls from the *ovarium* or *fimbriae* into the abdomen.

Sometimes conception happens during pregnancy.

Corpora Lutea is a name that has been uſed ever ſince the days of Malpighi for that cicatrix which grows in, and fills up the veſicles of the *ovaria* (Note 430.), which are ruptured during the venereal orgaſm. In appearance, a *corpus luteum* is yellow, and like a conglomerate gland. When cut, it diſcovers a double ſubſtance, like a cortical and medullary part (Wriſberg's *Annct. in Pr. Lin. Halleri* § 577.).

It has been queſtioned, Whether *corpora lutea* ever appear, except after coition? Haller ſays, they only appear after coition, and pregnancy. Buffon maintains a contrary opinion. But Blumenbach has lately given an opinion more favourable to Haller, and more countenanced by analogy. As the females of birds have all the changes that women have in their genitals, and lay eggs without the influence of the male, which eggs are however addle;

very ſmall in the *uterus* of virgins, increaſe in ſize, and become tumid with blood in women bearing children.

The Cavity of the *uterus* increaſes by degrees, and is more and more expanded by the increaſe of the *foetus*. The neck of the *uterus*, and its whole ſubſtance, becomes thicker, and more ſpongy; the *os uteri* is cloſed (434), and the *menſtrua* ceaſe, becauſe the blood which was evacutated before is now retained to nouriſh the *embyro*.

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and, as fowls may conceive addle eggs without the male, by mere titillation of the genitals, he conceives that the *corpora lutea* of the virgins, whoſe diſſection is alluded to by Valiſneri and others, were formed in the *ovaria* in conſequence of ſome laſcivious artifice, ſimilar to the titillation of the genitals of Fowls. That the *ovaria* of girls, as well as of fowls, are affected by laſcivious play, Prof. Blumenbach confirms, by obſerving that *corpora lutea* are not ſeen in virgins till their fourteenth year; and that they ofteneſt appear in hyſterical girls. He ſays, no *ſtimulus*, except that of the male, can have this effect on quadrupeds; and hence he accounts for the appearance of *corpora lutea* in the females of the human ſpecies and birds only, that have had no previous connection with the male. Hence he thinks the opinion of Haller highly excuſable (*Specimen Phyſiologiae Compar. inter Animantia calidi Sanguinis Vivipara et Ovipara.* See the *Comment. Reg. Soc. Gottin. Vol.* IX.).

(434) The *os uteri* is ſaid to be cloſed to prevent the eſcape of the *ovum*, and to retain the *ſemen maſculinum.* In brutes the *uterus* is alſo ſaid to be always ſhut up after conception; and they never copulate afterwards. But women given to proſtitution ſeldom conceive, becauſe their *uterus* is ſo often opened that it is rare indeed for the *ovum* not to eſcape.

Of the opening and ſhutting of the *os uteri internum*, conſult the former note (Note 433.).

The *Placenta* is a ſmooth, round, ſpongy body, very like a diſh, generally fixed to the *fundus* of the *uterus*.

There are to be conſidered in the *placenta*

The *Superior Surface*, which is rough and unequal, and fixed to the extremities of the umbilical veſſels by cellular membrane, and in this manner alſo to the *uterus* itſelf.

The *Inferior Surface*, which is ſmooth, having the umbilical cord implanted in the middle.

Its *Round Margin*.

Its *Fabric* is made up of the branches of the umbilical veſſels and denſe cellular membrane (435). Both its ſurfaces are covered by the chorion.

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(435) The *placenta* is formed entirely by the *foetus*, and it is compoſed principally of the ramifications of the veſſels of the *embryo* (Note 433.). Mr. Hunter traced the arteries and veins of the *uterus* towards the *placenta*, and found them ſoon to loſe the regularity of veſſels, by terminating at once, upon the ſurface of the *placenta*, in a very fine ſpongy ſubſtance. The arteries, he ſays, previous to their termination, make a twiſt, or cloſe ſpiral turn upon themſelves. Moreover, he ſays, that oppoſite the mouth of the artery, the ſpongy ſubſtance of the *placenta* was readily obſerved (On the ſtructure of the *placenta*, p. 129.), and that its regularity and form proved it to be a natural cellular ſtructure, fitted to be a reſervoir for blood.

The veſſels of the *uterus* ramify upon the *membrana decidua* (Note 442.), and, after paſſing through it, open into the cellular ſubſtance of the *placenta*. The cellular ſubſtance of the *placenta* is therefore like the cavernous ſubſtance of the *penis*.

Its *Uſe* is, to receive blood from the *uterus*, and to return it by the umbilical veins.

The *Umbilical Cord* conſiſts of two arteries, a vein, and the *urachus*, all joined together by a common membrane, which is ſpongy internally, and a production of the ſkin of the *foetus*.

The *Arteries* ariſe from the internal iliac arteries of the *foetus*, and terminate in the *placenta*.

The *Umbilical Vein* comes from the *placenta* by numerous branches, and riſes into tubercles in ſome parts of its courſe, and enters the navel with the other umbilical veſſels, between the ſeparating arches of the ſkin and abdominal muſcles, and is laſtly terminated in the liver of the *embryo* (436).

The *Urachus* ariſes from the baſe of the urinary bladder, and terminates in the umbilical cord. In brutes it is hollow; and ſome Anatomiſts have found a cavity even in the human *urachus*.

Its *Length* is equal to thrice the breadth of one's hand (437).

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(436) The umbilical vein is without valves.

(437) The bad conſequences of the umbilical cord being too long, or too ſhort, may be learned by conſulting thoſe great anatomiſts, Morgagni (De Sedib. et Cauſ. Morborum. Ep. 48. p. 25.), Ruyſch (*Adverſ. Anat. Med. Dec.* II. *p.* 29.), Bonetus (*Sepul. Anat. L.* III. *S.* 38.), and Albinus (An. Acad. L. I. Tab. V. Fig. IV. V.), or by peruſing books on Midwifery, or by conſidering the office of the umbilical veſſels. Conſult the Medical Journal, Vol. 8. page 182.

The *Uſe of the umbilical vein* is to carry blood from the *placenta* into the *foetus: the Uſe of the two umbilical arteries* is to carry blood from the *foetus* to the *placenta.*

The *Foetus* itſelf, or the *Embryo*, is contained in the cavity of the *uterus*, encloſed in membranes proper to it (438).

Of the *Membranes of the Foetus:* the *Firſt* and *Moſt Exterior* is villous, eaſily torn, endowed with blood-veſſels, covering both ſides of the *placenta*, and attached to the whole internal ſurface of the *uterus*, by cellular membrane and ſmall veſſels. This membrane is called the *Chorion.*

The *Middle Membrane*, within the former, is white, and not pellucid; it is firmer than the *chorion*; it covers only the lower part of the *placenta*, that is oppoſite the *foetus*, and it is united by cellular membrane with the *Chorion* and *Amnios* (439).

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(438) The *foetus* is inviſible in the *ovum* till the nineteenth day; after which it appears like a worm, crooked, with a divided head, contracted at its tail. On the twenty-firſt day, the mouth is open, and the beginnings of the *thorax*, the limbs and the heart and liver are conſpicuous.

Till ſome days after conception the *ovum* is inviſible, and cannot be diſtinguiſhed from the *mucus* of the parts. Haller thinks all obſervations falſe, that are intended to prove the appearance of the new man before the twentieth day *(Op. Min. Tom.* II. and *El. Phyſ. Vol.* VIII.)

(439) Haller calls it *Membrana Media (Primae Lin. Phyſ.* § 893.). By ſome it has been deſcribed as an *Allantois.* Some have conſidered it only as the internal *lamella* of the *chorion*; and ſome have referred it to the *amnios.* Wriſberg calls the Middle Membrane *Laeve Chorium* (Notes on Haller's *Pr. Lin.).*

The *Inmoſt Membrane*, which is next the *foetus*, is a very thin, tranſparent, membrane. It is attached under the *placenta*, like the middle membrane; it is completely full of a watery liquor, and it is called *Amnios*.

If there be many *fœtus* at the ſame time, each has its proper and peculiar *amnios*.

The Liquor contained in the *amnios*, agrees in nature with the *ſerum* of the blood; it coagulates when heated, like *ſerum*. As pregnancy advances, the quantity of this liquor is leſſened (440).

The *Uſe of the Liquor Amnii.* It defends the *foetus* from violent impreſſions: perhaps the *foetus* is nouriſhed by it (441). During labour it dilates the orifice of the womb, and lubricates the *vagina*.

Beſides the three membranes above-mentioned, that great anatomiſt Hunter detected a fourth membrane belonging to the

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(440) The celebrated Haller would not believe that the liquor contained in the *amnios* is ſeparated from the branches of the umbilical arteries, but conjectured that it exſuded from the *uterus* through the *chorion* and middle membrane, or through the *placenta*, into the *amnios*. But I think that the *liquor amnii* is poured out of the mouths of the branches of the umbilical arteries, which Cowper ſaw ramifying upon the *amnios*, and through which Monro ſaw water paſs that he had injected into the umbilical arteries (Medical Eſſays of Edinb. Vol. 2. p. 189.).

(441) Boerhaave imagined that the *fœtus* ſwallows the *liquor amnii*, and is nouriſhed by it (*Inſt. Med.* § 682.). He does not however deny but that it is chiefly nouriſhed by the umbilical cord.

embryo, which covers the whole internal ſurface of the gravid *uterus* and *placenta.* He gave it the denomination of *Membrana decidua* (142).

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(142) The *Membrana Decidua*, or *Caduca* of Doctor Hunter, is ſo called becauſe it is caſt off with the *placenta.* It was formerly called the Spongy Chorion. When the ſeed, or *foetus* has come into the *uterus*, it is covered, as I noticed before, with coagulable lymph. It is this coagulable lymph which forms the ſoft pulpy membrane, called *Decidua.*

The *Membrana Reflexa* of Dr. Hunter is that part of the *Decidua* which covers the ſeed, or *foetus*, where it is not attached to the *uterus.*

The *Membrana Decidua* becomes thinner as the *uterus* is more diſtended by the *foetus.* It is thinneſt where it is called *reflexa.* It is moſt diſtinct where it covers the *chorion*, and it is leſs elaſtic than the chorion.

The *Membrana decidua* paſſes between the *placenta* and *uterus* ; conſequently, it is a part of the mother. The veſſels of the *foetus* never enter into it.

Mr. Hunter ſays, " I alſo obſerved that the ſpongy chorion, called the *decidua* by Dr. Hunter, was very vaſcular, its veſſels coming from and returning to the *uterus* (Obſ. on certain Parts of the An. Oec. p. 129.).

Doctor Hunter ſays that if this membrane peel off, and is evacuated, the female miſcarries, which is certainly true. But I have heard an experienced teacher of Midwifery declare that he knew it evacuated every month, in a female that was not pregnant.

Doctor Foſter conſidered the *membrana decidua* as the external chorion (Principles and Practice of Midwifery.).

Of the Difference between the Embryo and the Adult.

1. In a *foetus* there is a larger quantity of fluids, and the ſolids are generally ſofter than in adults.

2. In a *foetus* there is a peculiar canal, which is called *Canalis Venoſus*; it paſſes from the *ſinus* of the *vena portae* into the *vena cava*, but, like the umbilical vein and arteries, this canal becomes impervious in adults (443).

3. The Liver, conſidering the proportionate ſize of the whole body, is much larger than that of adults.

4. The Lungs of *foetus* are ſmall, firm, and livid; they ſink when thrown into water. In adults, whilſt alive, the lungs are enlarged by the action of reſpiration, and appear more expanded; they are ſpongy and white, and they ſwim if thrown into water (444).

5. In a *foetus* there is a duct paſſing from the trunk of the pulmonary artery into the *aorta*, carrying blood from the former to the

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(443) The capacity of the umbilical vein is much greater than that of the *ductus* or *canalis venoſus*; ſo that all the blood of the umbilical vein does not go through the *ductus venoſus* into the *vena cava*. Indeed, the greater part goes to fill the left branches of the *vena portarum*, and paſſes from theſe into the hepatic veins, and then into the *vena cava*.

(444) Conſult Doctor Hunter's paper on this ſubject (Med. Obſ. and Inq. Vol. 6. p. 266.).

latter, which is called *Canalis Arterioſus.* In adults it is cloſed up (445).

6. The *Foramen Ovale,* which is an opening in the partition of the two auricles of the heart of a *foetus,* for the paſſage of blood from the right auricle to the left. This is alſo cloſed up in adults (446).

7. The *Valvula Euſtachii,* which is ſituated interiorly, between the *vena cava inferior,* and the ſac into which this vein is expanded near the heart, is larger in *foetus* than in adults (447).

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(445) The *Canalis Arterioſus* concurs with the *foramen ovale* to tranſmit a proper quantity of blood into the *aorta* (Note 446.).

The *canalis arterioſus* at its origin is of greater capacity than both the pulmonary arteries.

(446) The *Foramen Ovale* is open in a *foetus,* becauſe the lungs are collapſed, and tranſmit only a ſmall quantity of blood, and becauſe the left ventricle is perfectly formed before the right is viſible (Haller *Format. du Poulet.*). For if the *foramen ovale* did not tranſmit blood from the right *ſinus* of the heart to the left, the left ſide of the heart, and the *aorta* could not receive their proper complement (Note 445.).

The Figure of this *foramen* is that of an ellipſis. Its upper margin is bounded by a fleſhy eminence; the *cornua* of which decreaſe in ſize as they deſcend. In adults the remains of this opening are conſpicuous, and called *Foſſa Ovalis,* being thinner at that part than any other. This thin part is ſurrounded by a ridge called *Annulus Ovalis,* or *Iſthmus Vieuſſenii.*

(447) This is not peculiar to the *foetus,* nor is it uſeleſs in the adult, for it forms the ſide of the right auricle, and hinders the return of blood from the right auricle into

8. The Thymus Gland, the Head, the Liver, the Supra-renal Glands, and the Vermiform Proceſs of the *inteſtinum coecum* are much larger in *foetus* than in adults.

9. The Stomach and Inteſtines of *foetus* are filled with *foeces* of a duſky green colour, and a tenacious conſiſtence, called *Meconium*. The large inteſtines are not ſo capacious as in adults, conſidering their relative proportion to the reſt of the body, but they are dilated after birth. The Stomach is likewiſe more elongated.

10. The *Membrana Tympani* is covered with another membrane, that is white and mucous, but diſappears after birth.

11. The *Meatus Auditorius Externus of an embryo* (to the *ſulcus* of which the *membrana tympani* adheres), is ſeparated from the *os petroſum*, but unites with it after birth.

12. The Pupil is bounded by a membrane, called *Membrana Pupillaris*, which diſappears after birth (448).

13. The

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into the inferior *cava*, during the contraction of this auricle (Haller, *Elem. Phyſ. Tom.* I. *p.* 320. alſo his *Program. de Valvul. Euſtachii*, *Op. Minora. Tom.* I. *p.* 24, &c.).

This valve is broader in *foetus* than in adults (Trew, *De Diff. inter Hominem nat. et naſcend.* § X.).

See the circulation of the blood in a *foetus* deſcribed, at the end of the Angiology.

(448) The *Membrana*, or *Tunica Pupillaris*, is always preſent about the ſeventh month, but cannot be diſcovered

13. The Teeth are hidden in the *maxillae*, and reſemble mucous follicles; they gradually become firmer after birth, till they at length cut the gums (449).

14. The *oſſa parietalia* on the top of the head are, as yet, not grown together, ſo that

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vered at the ninth. Wriſberg however ſays that he found it once after birth, though he confeſſes that it commonly diſappears before the laſt month of pregnancy (*Animad. in Pr. Lin. Phyſ. Halleri* § 512.). It is often blackiſh, but ſometimes of a whitiſh aſh colour. While it is preſent the *camerae* of the eye are really ſeparated. Roederer tells us how to ſeparate it—“ *Cautius eximatur humor* “ *vitreus atque cryſtallinus, perforetur cornea, immittatur* “ *flatus in cameram anteriorem, verſus poſteriora elevabitur* “ *membranula tenerrima: vel et dirigatur flatus a camera* “ *poſteriori, non penetrabit in anteriorem, ſed verſus ante-* “ *riora attolletur membranula.*”

Doctor Hunter ſays that the *membrana pupillaris* has two ſets of arteries, one from the *iris*, which is larger, and another much ſmaller, but very numerous, from the cryſtalline *capſula*. He ſays, the artery of the cryſtalline *capſula* does not terminate at the great circle of that humour; its ſmall branches paſs that circle, and run a very little way on the anterior ſurface of the cryſtalline humour before the points of the ciliary proceſſes. Then they leave the humour, and run forwards, ſupported on a very delicate membrane, to loſe themſelves in the *membrana pupillae* (Med. Comment.).

Haller has given a beautiful engraving of this membrane (*De Nova Tunica Pupillam Foetus Claudente, &c.*).

As to the uſe of this membrane, Blumenbach ſays, it is not only to form the *iris* in the *foetus* (See the deſcription of the *Iris* in the chapter on the Eye.), but alſo to prepare for its future eaſy motion; for when the *iris* is completed, the *membrana pupillaris* ſoon diſappears (*De Oculis Leucaethiopum et Iridis motu Commentatio.*).

(449) See the *Oſteology* (Note 81.).

they incloſe an aperture, which is cloſed only by a membrane, called *Fontanella* or *Fnſi Pulſatilis* (450).

15. All the bones of the body are ſofter than in adults, and the *Epiphyſes* are not yet joined to the proper bones.

16. Laſtly, the mucous and articular cavities are not yet perfectly formed.

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(450) See the *Oſteology* (Note 21.).

SECTION II.

SPLANCHNOLOGY.

The Thorax.

THE *Thorax* is that part of the body which extends from the neck to the diaphragm: it is ſurrounded by the *ſternum*, the ribs, and the dorſal *vertebrae*; and is internally covered with a common tunic, called the *Pleura*, which is divided by the *Mediaſtinum* into two cavities.

Externally, on the thorax, are placed the two *Mammae*.

In the *cavity of the thorax* is included the Heart, with its large veſſels, and the *Lungs*.

Anteriorly, the *Thymus* Gland is placed.

Poſteriorly, is ſituated the *Oeſophagus*, the *Vena Azygos*, the Thoracic Duct, the Eighth Pair of Nerves, and the Great Intercoſtal, and Diaphragmatic Nerves.

Of

Of the Mammae.

The *Mammae* are two convex hemiſpherical parts, ſomewhat hard; which are ſituated anteriorly on each ſide of the thorax, and deſtined for the ſecretion of a white and nutritious liquor, called *Milk* (451).

The *Mammae* are placed upon the *muſculus pectoralis major*, and covered externally by the integuments which are common to the whole body (452).

We may notice,

1. A prominent and very irritable body, of a ſpongy and cellular fabric, ſituated in the middle or centre of each *mamma*, and perforated with ſmall *foramina* (or the openings of the excretory ducts which contain the Milk. It is called the *Nipple* (453).

3. A *Halo*,

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(451) In Men, the breaſts are called *Mamillae*; in Women, *Mammae*; and in Brutes, *Ubera*. The *Mamillae* and *Mammae* of Man, and the *Ubera* of Brutes, both male and female, are of the ſame ſize at birth, and contain Milk.

The common number of *mammae* in the human ſpecies, is, as mentioned in the text, two. Bartholine, however, ſays—"*Joh. Walaeus in quadam muliere tres obſervavit, ſiniſtro latere duas, a dextro unam: et Cabrolius obſervavit in quadam muliere quatuor* MAMMAS, *utrinque geminas (Anatomia Reformata.).*"

(452) The ſummit of the hemiſphere is commonly at the inferior margin of the ſecond true rib: the inferior part of the circumference is oppoſite the fifth true rib.

(453) I have ſearched in all the books I have on Anatomy; but I cannot find an inſtance of two nipples on

one

3. A *Halo*, or Red Circle around the nipple, which becomes ſomewhat brown in old people, and is beſet with many ſebaceous glands. It is called the *Area.*

As to the *Internal Fabric of the mammae*, it is made up of very much ſoft fat, which extends round about, and chiefly conſtitutes the

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one *mamma* related in any. Where there were three, or four *mammae*, there, I ſuppoſe, the number of nipples was correſpondent, as in the caſes related by Bartholine (Note 451.). But there is a woman, Ann Sidley, aged 22, living at Chatham, whom I have ſeen, and examined, that has only two breaſts *(mammae)*, but three nipples *(papillae)*, two being on the right breaſt.

I have ſaid ſhe has two *mammae* only. For neither myſelf, nor any other perſon preſent with me, could diſtinguiſh any diviſion of the right *mamma*. Beſides, let which nipple ſhe pleaſe be ſucked, the natural central one, or the ſupernumerary one, at the circumference of the *mamma*, oppoſite the ſixth true rib, yet the milk flows from both at the ſame time.

The Right *Mamma* is a little larger than the Left.

About a twelvemonth ago, I ſent the caſe of this woman, with a drawing, to my friend Dr. J. E. Smith, who is deſervedly a Fellow of the Royal Society, and well known to the learned world as poſſeſſing the Library and *Muſaeum* of the late celebrated Linné. I quoted in my letter to him the caſes of Walaeus and Cabrolius related by Bartholine (Note 451.), of three and four *mammae*; but in which not a word is ſaid of the *papillae*, much leſs of two *papillae* on one *mamma*. Nevertheleſs, I received from my friend a moſt polite letter, containing the thanks of the Royal Society for my intention, "although they would not think ſuch a caſe proper for publication, as Bartholine has already deſcribed a ſimilar one."

Now could I have made ſo great a miſtake, in quoting the ſentence of Bartholine (Note 451.), as to write *papillas* inſtead of *mammas?* Certainly Bartholine does not contain ſuch a caſe as I related of Ann Sidley.

ſubſtance

ſubſtance of the *mammae*. It conſiſts alſo of a large eminent gland, which is compoſed of many leſs glands, arteries, veins, nerves, lymphatic veſſels, and the proper excretory ducts, containing milk. Each of theſe parts is encloſed in a firm, white, cellular texture; and they are all united together.

The *Arteries of the Mammae* come from the internal mammary arteries, which ariſe from the ſubclavian artery; and from the external mammary arteries, the humeral and intercoſtal arteries. The ſmall branches of theſe arteries are united with the epigaſtric arteries.

The *Veins of the Mammae* have the ſame names as the arteries: they are more manifeſtly connected with the epigaſtric veins.

The *Lymphatic* Veſſels of the *mammae* are continued into the axillary glands.

The *Nerves of the Mammae*, which are in great number, ariſe from the ſuperior intercoſtal nerves.

The *Excretory Galactophorus Ducts* are very ſmall, ſoft, white ducts, ariſing from the large mammary gland before mentioned, running in all directions to the middle of the nipple, uniting in the *area*, and opening by eight or ten orifices in the nipple (454).

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(454) The *Tubi*, or *Ductus*, *Galactophori*, or *Lactiferi*, are twenty, or more, Haller ſays, opening at the *papillae* (*Primae Lin. Phyſ.* § 946.): and in his notes on Boerhaave's Inſtitutions, he ſays, there are never leſs than fifteen. Kolpin ſays fifteen is the conſtant number, though not more than thirteen can be ſhown, whether you fill them

The *Uſe of the Mammae* is to ſecrete and contain milk ([455]), for the nutrition of infants. Even

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them with mercury, or any thing elſe; the other two being ſo ſmall (*De Struct. Mam.* § 59.).

Theſe ducts do not communicate with one another. There are no anaſtomoſes between them. J. T. Walter injected the lactiferous tubes, and filled each with a differently coloured matter; but he could not find the leaſt communication (Kolpin, *De Struct. Mam.* § 53.).

([455]) Milk is a white apparently homogeneous fluid, ſecreted in the breaſts of women, of the females of quadrupeds, and of cetaceous fiſhes.

In infancy, a ſerous milk-like fluid may, and ought to be expreſſed from the *mammae* of both boys and girls (Morgagni, *Adv. Anat.* V.): Duvernoi ſays that in Ruſſia men have frequently milk in their breaſts (*Acta Petrop. Tom.* 2.): and Boerhaave in his Academical Lectures on § 690, affords an inſtance of a man giving ſuck. See Polyc. Fr. Schacher, *Proluſ. de Lacte Viror. et Virgin: num illud nutriendo infanti ſufficiat? Lipſ.* 1742.

Milk is ſpecifically heavier than water, and lighter than blood.

Viewed on the ſtage of a microſcope, it ſeems to conſiſt of opaque globules floating in a tranſparent fluid.

Milk is neither acid nor alkaline. Dr. Clarke, by a very fair experiment, proves that human milk is not prone to run into an aceſcent, or acid ſtate. He *ſays*—"I once kept a few ounces of a nurſe's milk, delivered about ſix or ſeven days, for more than two years, in a bottle moderately corked. It ſtood on my chimney-piece, and was frequently opened and examined. At the end of this period, it ſhowed evident marks of moderate acidity, whether examined by the taſte, ſmell, or paper ſtained by vegetable blues, or purples; the latter it changed to a florid red colour, whereas cow's milk, kept a few days, changed the colour of the ſame paper to a green, thereby clearly ſhowing its putreſcent tendency (Tranſact. of the Royal Iriſh Academy, 1788.)."

Haller, who had learnt from a M. Navier, that human milk is not ſo prone to aceſcency as cow's milk, conſiders

Even in men there is a large mammary gland, and a nipple, and an *area* ſurrounding it:

ſiders it as an effect of animal food. But Dr. Clarke remarks——"many of my experiments were made on the milk of women rigidly confined to gruel, bread, and whey, and therefore the phenomenon obſerved by Navier was probably not the effect of animal diet."

If cow's milk be ſuffered to remain at reſt, whether in the open air, or in cloſe veſſels, it undergoes a ſpontaneous but imperfect ſeparation into an oily part, called *Cream*, a coagulable part, called *Curd*, and an aqueous part, called *Whey*. On the contrary, woman's milk contains no coagulable part; or it contains ſo little as not to admit of ſenſible proof. Woman's milk is not coagulated by acids, nor by ardent ſpirits, nor by a watery infuſion of the ſtomach of ruminant animals. Dr. Young proved that no artificial means were adequate to ſeparate curd from human milk; and Dr. Clarke has lately proved that human milk is not coagulated in the ſtomach of infants. This latter writer placed ſeveral portions of human milk in a temperature of 96° of Fareheit's ſcale; but he could not diſcover the leaſt tendency to coagulate in it, at the expiration of ſeveral hours. He ſays, however, that—"the cream was thrown to the ſurface thick and adheſive, and entirely ſeparated from the fluid underneath, which had ſomewhat of a grey, wheyiſh appearance, as uſual."

The chemical examination of milk belongs not to this place. It is only neceſſary to obſerve, that woman's milk contains more oil and more ſaccharine matter than any other.

As the enlargement of the *mammae*, and the production of milk are coeval with the new offspring, and as the new offspring is inſtinctively led to ſuck, it is highly probable not only that milk is the beſt food for babes, but alſo that the fitteſt milk for every new-born animal is that of the ſpecies to which it belongs. Indeed, this latter inference muſt appear evident from conſidering the difference between human milk, and the milk of ruminant animals, as mentioned above.

Dr.

it: nevertheleſs, it is certain, that milk has very ſeldom been ſecreted in men.

Dr. Cullen thinks the mother's milk the moſt proper, becauſe, by its vegetable nature, it leſſens the alkaleſcency of the blood, which is as alkaleſcent in a foetus as the human oeconomy can admit, and, becauſe, by its being partly of an animal, and partly of a vegetable nature, it is more accommodated to the ſtate of the infant veſſels, adapted hitherto to a fully alkaleſcent blood (Mat. Med. Vol. I.).

It has been ſaid that milk is the fitteſt food for babes, as ſtanding in no need of aid from the digeſtive organs. But Dr. Cullen ſays milk becomes ſolid, and muſt be made fluid again, and probably ſour, before it can be made chyle. I wonder that Dr. Cullen did not formally object to Dr. Young's experiments, which prove the direct contrary of this, as I have noticed above.

Milk certainly differs greatly from chyle; for chyle coagulates on expoſure to air, or by ſtagnation. But chyle and milk being ſomewhat analagous in appearance; chyle being frequently ſeen floating in blood recently drawn from the arm; the odour, taſte, and ſome other qualities of ſubſtances laſt taken in, being ſenſible in the milk; the preſence of ſaccharine matter, and oil in the milk; and the conſtantly increaſed ſecretion of milk after eating, all render it extremely probable that,—although chyle and milk be not identically the ſame,—milk is formed immediately of the chyle, while it remains unaſſimilated in the blood.

It may be difficult to embrace this opinion, conſidering the agitation and diffuſion which many have always aſſigned to the common maſs, in its courſe from the right ſide of the heart through the pulmonary veſſels. But it is equally difficult to ſuppoſe how the ſugar of the milk can be derived from the blood, which contains no ſugar.

Of the Pleura, Mediaſtinum, and Pericardium.

I.

The *Pleura* is a thick, ſtrong, tranſparent, and cellular tunic; internally lining the ribs, the *ſternum*, the dorſal *vertebrae*, and the diaphragm; and, conſequently, the whole thoracic cavity.

The internal ſurface of the *pleura* is very ſmooth; but the external ſurface is encompaſſed with cellular membrane.

II.

The *Mediaſtinum* is a production of the *pleura:* it conſiſts of the two *laminae* of the *pleura*, joined together by cellular membrane. The *Mediaſtinum* divides the cavity of the breaſt perpendicularly into two parts; ſo that with the *pleura*, it conſtitutes two membranous bags, in which the lungs are contained. Theſe two bags, containing the lungs, are placed obliquely, in ſuch a manner, that they recede inferiorly from each other, and encloſe a triangular ſpace, in which there is a third bag including the heart, called the *Pericardium*.

The *Mediaſtinum* is attached *anteriorly* and ſuperiorly to the *ſternum*; but, as it deſcends, rather on the left ſide, it adheres to the margin of the *ſternum*, and the cartilages of the ribs: hence the right cavity of the *thorax* is broader than the left.

Poſteriorly, it is connected to the dorſal *vertebrae:*

Inferiorly, it is connected to the diaphragm and *pericardium:*

Superiorly, it is connected to the large blood veſſels.

Poſteriorly, at the *vertebrae* of the back, between the two bags of the *pleura*, there is a triangular ſpace, in which is contained the *aſpera arteria*, the *oeſophagus* behind it, the *vena azygos*, the thoracic duct, and, in part, the *aorta*. Anteriorly, the *Thymus* gland fills up a ſimilar ſpace.

The *Blood-Veſſels* of the *Pleura* and *Mediaſtinum* come from the contiguous parts.

The *Uſe of theſe Tunics* is to line the inſide of the *thorax*; to divide it into two cavities, and to afford an external coat to the Lungs and Heart (456).

III.

The *Pericardium* is a membranous ſac, containing the heart; but not grown together with the ſubſtance of the heart. It is ſituated at the bottom of the ſpace of the pulmonary bags; and is accordingly ſurrounded laterally and ſuperiorly by the *mediaſtinum*.

Its *Fabric*. It conſiſts of two membranes, the external of which comes from the *mediaſ-*

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(456) See Note 357.

tinum; but the internal is proper, conſiſting of firm and condenſed cellular membrane. Between both theſe membranes there is a cellular texture of greater rarity than either.

The *Pericardium* adheres ſuperiorly to the large veſſels of the heart, and to the *mediaſtinum*; inferiorly to the tendinous fibres of the diaphragm. It is alſo to be noticed, that a watery fluid is always contained in the *pericardium*, in its natural ſtate, the uſe of which liquor is to prevent the heart from growing together with the *pericardium* (457).

The *Arteries* of the *pericardium* ariſe from thoſe of the *aſpera arteria*: ſome, however, ariſe from the arteries of the *mediaſtinum* and diaphragm.

The *Veins* are terminated in the *vena ſine pari*, in the intercoſtal veins, the thymal veins, and thoſe proper to the *aſpera arteria*.

The *Lymphatic Veſſels* paſs to ſome adjacent lymphatic glands (458).

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(457) In a *foetus* the *pericardium* is very thin and tranſparent, and is liable to be ruptured by mere inflation with air. It is larger than is neceſſary to contain the heart (H. A. Wriſberg, *An. Embryon. Obſ.* V. *pag.* 60. § 14.): in an adult it is twice as big as the heart (Boerhaave, *Prael. in Inſt. Med. T.* II. *p.* 94.).

It is apparently more vaſcular in a *foetus* than in an adult (Senac, *Tr. dû Coeur. T.* I. *p.* 16.). According to Wintringham's experiments, the *pericardium* of an adult is more robuſt than any other membrane of the body: and Marherr ſays it is ſtronger than the *aorta* (*Prael. in Boerh. Inſt. Med.* § 182.).

(458) The nerves of the *pericardium* are from the ſuperficial branches of the cardiac nerves (Haller, *Pr. Lin.* § 81.).

The *Uſe of the Pericardium* is to defend the Heart, and to refrain its inordinate motion.

Of the Heart.

The *Heart* is a hollow muſcle, encloſed in the *pericardium*, and ſituated, in man, almoſt tranſverſely on the left ſide of the diaphragm, and in the anterior cavity of the *thorax*.

We ſhould remark in the heart,

Its *Baſe*, or broad part, turned towards the right ſide.

Its *Apex*, oppoſite the left ſide, and beating in ſome manner againſt the ſixth true rib.

Its *Superior Surface* is convex:

Its *Inferior Surface* is flat, lying upon the diaphragm.

Its *Anterior Margin* is acute, continued from the baſe to the apex, and formed from the right, or anterior ventricle of the heart.

Its *Poſterior Margin* is round, continued like the anterior, and formed from the left, or poſterior ventricle of the heart.

The Heart is divided into

1. The *Heart* properly ſo called:
2. The *Atrium*, or Porch of the Heart.
3. The *Principal Trunks* of the blood-veſſels, which ariſe from the heart.

I.

The Heart itſelf is divided into two *ventricles.*

The *Poſterior* or *Left Ventricle* of the heart, which is the primitive heart (459) is narrower, and in general the leſs. Nevertheleſs, it is by far the thicker, ſtronger, longer, and rounder It is divided from the right, by means of a partition; which is for the moſt part proper to itſelf.

The *Anterior* or *Right Ventricle* is broader, larger, ſhorter, thinner, and weaker, by far than the poſterior. A very ſmall part of the *ſeptum*, by which this ventricle is ſeparated from the other, is proper to this ventricle; but ſeems rather like an appendix faſtened to the left ſide of the heart by muſcular fibres (460).

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(459) The left ventricle is formed before the right; and there is only one ventricle for the firſt four days after conception (Haller, *Sur la Formation du Cœur dans le Poulet, &c.)*

(460) Wriſberg prefers calling it *Ventriculus pulmonaris*, becauſe it alone conveys the blood into the lungs, and is wanting in animals which draw in much air (*Annot. in Pr. Lin. Halleri*, § 92.). In an adult, the ventricles are nearly of the ſame capacity, containing two or three ounces of blood; but, after death, the right ventricle is generally larger than the left, becauſe it is diſtended with blood (Sabatier, *E. in vivis animalibus ventriculorum cordis eadem capacitas. Paris*, 1772. *8vo.*).

The *Fabric* of the heart is entirely compoſed of muſcular fibres; which may be divided chiefly into three different layers.

The *Outermoſt Fibres* of the Heart paſs from its baſe to its apex, and ſurround the whole heart.

The *Middle Fibres* which are next to the outermoſt, paſs in a direction more tranſverſe than the former. It is by means of this courſe that both the ventricles of the heart are formed.

The *Inmoſt Fibres* paſs obliquely from the baſe to the apex; but very many other fibres run backwards within both ventricles of the heart, in the ſame direction as they deſcended; and others go off in a perpendicular courſe, to be united into ſmall bundles, of which the columns, *trabes*, and different furrows of the heart are made: and, laſtly, they vaniſh with tendinous extremities in the valves of both ventricles (461).

The

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(461) The deſcription of the fibres of the heart, as given by Lower and Boerhaave, is taken from brutes (*Marherr*, *Praelect. in Boerh.* § 184.): for in man there are ſcarcely any parallel fibres; and there are no ſtraight fibres, from the baſe of the heart to the apex, as Lower deſcribed.

The celebrated Wolffius, I believe, is the beſt writer on this ſubject. He ſays, the texture of the heart is very ſingular, and very unlike that of muſcles. It conſiſts of bundles of fibres, running more or leſs obliquely, and turning in a wonderful manner, forming *ſtrata* that lie one upon another. He ſays, moreover, that theſe are fixed to the baſe of each ventricle by four cartilaginous threads, which ſupport the fleſhy fibres of the ventricles, and

The external ſurface of the heart is univerſally covered by a firm and ſmooth tunic; the internal ſide of which is covered by cellular membrane, filled, for the moſt part, with fat.

Each ventricle of the heart has two orifices; one leading into the contiguous *atrium*, another into the artery.

The orifice of the anterior ventricle, directed towards the *atrium*, is oval, and terminated by a white, tendinous margin. From this margin there ariſes a membranous circle, formed of three parts unequally quadrangular, called by the ancients *Valvulae Tricuſpidales.* Theſe valves are fixed to the *carneae columnae*, by means of ſtrong tendinous fibres, near the ſides of the heart.

The orifice of the poſterior ventricle, which opens towards the *atrium*, has only two valves, called *Valvulae Mitrales.*

The *Arteries* deſtined for the nouriſhment of the heart ariſe from the aorta, and are known by the name of the *Right* and *Left Coronary Arteries.*

To the *Veins* we may refer the *Large Coronary Vein* of the right auricle, and ſmall *Coronary Vein* inſerted into the ventricle.

The *Lymphatic Veſſels* are evacuated into the contiguous lymphatic glands.

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and diſtinguiſh them from the fibres of the ſinuſes (*Comment. De Rebus in Scientia Naturali et Medicina, &c. Lip. Vol.* 30. *p.* 122. *Vol.* 31. *p.* 201. 239. & 426.).

The *Nerves* of the heart ariſe from the cardiac *plexus*, the *geneſis* of which may be ſeen in the *Neurology*.

II.

The *Atria* of the heart are two cavities in its baſe, placed over the orifices of the ventricles : each *atrium* conſiſting of a *ſinus* and auricle.

The two ſmall blind, and ſerrated ſacs, which are ſeen in the *atria*, are called *Auricles* ; the reſt of the cavity of the *atria* is called the *Sinus* of the heart. They are connected not only to the membranes, but alſo to the coronary veins. They are divided, like the ventricles of the heart, by means of a partition, into the *Right*, or *Anterior*, and the *Left*, or *Poſterior Atrium*. This *Partition* in *foetus*, as already obſerved, is perforated ; but in adults it is moſt commonly cloſed up (462).

The right *ſinus*, and its auricle, is ſomewhat larger than the left.

They are compoſed of two membranes, between which there run many ſmall bundles of muſcular fibres : the internal membrane not only covers the whole cavity of the *atria*, but alſo the ventricles of the heart. It concurs likewiſe to form the *Valvulae Tricuſpidales*, and connects them to the *columnae* of the heart.

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(462) Beſides the ſixth volume of the *Medical Obſervations and Inquiries*, ſee the *London Medical Journal* Vol. VIII.

They have the ſame *Veſſels* and *Nerves* as the heart.

Their *Uſe* is to receive the blood returned by the large veins, and to empty it into the ventricles of the heart (463).

III.

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(463) What is now-a-day called the *Circulation of the Blood* was firſt publiſhed by William Harvey, an Engliſhman, at Frankfort, in Germany, 1628. It is deſcribed in two places of this work already; where Leber took a ſummary view of the Animal Oeconomy, and where the Angiology ends. At preſent, therefore, I will not repeat it; but only treat of thoſe means by which the circulation is regulated, and of the alternate contractions and relaxations of the arterial ſyſtem.

To render the paſſage of the blood through the different parts of the heart and arterial ſyſtem equal, and to prevent its retrograde courſe, Nature has placed valves at the union of the ſinuſes and ventricles, and alſo at the union of the ventricles with the arterial trunks. It is by the valves deſcending into the right, or anterior ventricle, called *tricuſpidales*, that the blood poured into the right ventricle is prevented from returning into the right auricle, during the contraction of this ventricle. It is by the valves deſcending into the poſterior ventricle, called *mitrales*, that the blood is hindered from returning into the left *ſinus* and auricle, during the contraction of the left ventricle. And it is by the valves, called *ſemilunares*, which are placed at the beginnings of the *aorta*, and pulmonary, that the blood contained in theſe arteries is prevented from returning into the heart, during their contraction. Thus the valves are preſſed againſt the ſides of the ventricles while they are receiving the blood of the auricles, and againſt the ſides of the *aorta* and pulmonary artery while they are receiving the blood of the ventricles. But the valves are raiſed from the ſides of the ventricles, and of the two arterial trunks, when the blood that has once paſſed them is likely to be driven back again. The valves are raiſed by the blood itſelf.

The *Euſtachian Valve*, conſidering its uſe, is peculiar to the *embryo*. In an adult it is very ſmall; and there is leſs

III.

The *Principal Great Trunks* of the blood-veſſels of the heart, are

The

leſs neceſſity for it, becauſe the blood of the pulmonary artery is prevented from returning into the right ventricle by the ſemilunar valves.

The *Tricuſpidales*, or *Triglochines*, are three unequal productions continued from a tendinous ring, at the beginning of the anterior ventricle. It was once ſaid that each of the productions ended in three points.

The *Mitrales* ariſe from a ſimilar ring at the beginning of the poſterior ventricle. They are two in number only, and are named from a ſuppoſed reſemblance to a Biſhop's mitre.

The *Semilunares*, or *Sigmoideae* are three in each of the large arterial trunks, ariſing like the former, but having muſcular fibres.

The poſition of the valves, and their known uſe, is a proof that the blood paſſes from the heart by means of arteries, and returns to it again by means of veins. For the ſemilunar valves, at the beginnings of the great arteries admit the paſſage of the blood into theſe arteries, but they prevent its return. And the *tricuſpidales* and *mitrales*, as well as the other valves of the veins, prevent the blood from regurgitating from the heart into the venous ſyſtem. This was noticed by Harvey.

The celerity with which the blood is moved in the arteries and veins is not yet aſcertained (Hales's Statical Eſſays.). It is moved more quickly in the arteries than in the veins, and more quickly in the trunks than in the branches. It is certainly moved more quickly in ſome men than in others; and its celerity muſt vary in the ſame perſons according to age, habit, and various other circumſtances.

The Heart, as well as the arteries, is alternately dilated and contracted during life. Its contraction is called *Syſtole*, its dilatation *Diaſtole*. Both auricles contract at once, The *Aorta*, which ariſes from the left ventricle of the heart, and

The

once, and ſo alſo do both ventricles. When the *atria* are contracted, the ventricles are relaxed, and *vice verſa*.

When the heart contracts, its *apex* is drawn towards its *baſis*, and the ſides of the heart are drawn towards the partition of the ventricles. Thus the cavities of the heart being obliterated, the blood which they contained, is forced from them into thoſe paſſages in which it is leaſt reſiſted; that is, the *aorta* and coronary arteries, and the pulmonary artery. The contractions of the ventricles, I have ſaid, is ſynchronous.

The ſituation of the heart during its ſyſtole is alſo changed. Its *apex* riſes in the arc of a circle forwards and ſomewhat to the right, and in riſing it neceſſarily ſtrikes againſt the fifth or ſixth rib, becauſe the cavity of the thorax is leſs above than below. Haller ſaw this take place when he filled the left *ſinus* of a dead body with air (*El. Phyſ. Tom.* I. *p.* 393.). Hence, the pulſation of the heart is felt during its *ſyſtole*; and hence the heart and arteries pulſate at the ſame time, becauſe theſe pulſate in their *diaſtole*.

The abſolute force of the heart cannot be aſcertained, becauſe we cannot determine how much blood is expelled from it at each *ſyſtole*, nor how long a time the expelled blood takes in paſſing to any diſtance from the heart.

Dr. Whytt, after the example of Bartholine (*Anat. Ref. Lib.* II. *Cap.* VI.) mentions and deſcribes three different ſtates of the heart, viz. *Syſtole*, or the contraction in all dimenſions; *Periſyſtole*, or the relaxation of the heart, and *Diaſtole* or its diſtenſion beyond the natural capacity (On the Vital and Involuntary Motions, &c.).

The force with which the ſyſtole of the heart is performed depends almoſt entirely on its irritability, and the continuance of its contractions and relaxations cannot be aſcribed to its nerves, becauſe the heart moves long after it is ſeparated from the reſt of the body. That its motions however may be influenced by cutting, tying, or ſtimu-

The *Pulmonary Artery*, from the right ventricle.

The

ſtimulating the eighth pair of nerves, is not to be denied.

Why does the heart continue its motions, in the ſame conſtant order for years, without reſting? Conſult Whytt on the Vital and Involuntary Motions, &c.

The heart then is irritated by the blood that flows into it, and hence follows its ſyſtole (Haller, *De Motu Cardis à ſtimulo nato. Comment. Soc. Scient. Goettingens. Tom.* I.).

Conſult Wilſon's Enquiry into the moving powers employed in the circulation of the blood, printed at London, 1774.

The motion of the blood in the venous ſyſtem of the liver, in the *placenta*, and in many other parts, can hardly be ſuppoſed to depend upon the force of the heart. The motion of the blood, even in ſome remote parts of the aortic ſyſtem, cannot depend on the *ſyſtole* of the heart. Whytt believed that the ends of the arteries, and the beginnings of the veins, have an *Oſcillation* of their own, independent of the heart, upon which the propulſion of their contents depends (Phyſiological Eſſays, &c.); and the *phoenomena* of inflammation favour his belief.

Of the motion of the blood in the veins, Verſchuir's Eſſay is in favour of their being irritable; ſo that this irritability, the *vis à tergo* from the arterial blood, and the valves, may be aſſigned as probable cauſes of the return of the blood by the veins.

The *Pulſation of the Arteries* is occaſioned by their *diaſtole*, though they are always full of blood in a living body, and not alternately filled and emptied like the heart. The ſtrength of animals is meaſurable from the pulſe of their arteries.

The pulſation is produced by the contraction of the heart, and neceſſary dilatation of the arteries, becauſe the blood contained in the arteries is an obſtacle to the free ingreſs of the blood to be expelled by the heart. Hence, the force of the circulation is greateſt near the heart; and we can perceive no pulſe at all in arteries of

a leſs

The *Vena Cava*, which terminates in the right *atrium*.

The *Pulmonary Veins*, emptying themſelves into the left *atrium* of the heart.

Conſult a fuller deſcription of theſe veſſels in the *Angiology*.

The Heart is *connected* above with the large veſſels, and *pericardium*, and below with the diaphragm.

The *Uſe of the heart* is to receive the blood returned by the veins, into the *ſinuſes*, and thence into the ventricles; from hence it is thrown into the lungs, by means of the arteries, and throughout the whole body.

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a leſs diameter than one ſixth of a line. The arteries ceaſe to beat where the veins begin.

It has been aſked, whether the pulſe at the wriſt depends upon the proper power of the artery, or upon the force of the heart (Kirkland's Inquiry into the preſent ſtate of Medical Surgery, Vol. I.)? I ſhall not preſume to anſwer the queſtion. Conſult De Lamure, *Recherches ſur la cauſe de la pulſation des arteres, &c. Monſp.* 1769.

The pulſe differs in different perſons, according to ſex, age, magnitude, climate, the circumſtances of ſleeping and being awake, of exerciſe and reſt, of paſſions of the mind, &c. It is quicker in women than in men, in children than in adults, in ſmall animals than in great, in warm climates than in cold, in animals that are awake than aſleep, &c.

Conſult a paper of Dr. Heberden's in the Medical Tranſactions, Vol. II. p. 21.

OF THE THYMUS.

(See the Adenology.)

Of the Lungs.

The *Lungs* are two *viſcera*, contained in the cavity of the thorax, filling the two bags of the *pleura*. They are parted from each other by means of the *mediaſtinum*, which divides the cavity of the thorax into two parts, and ſeparates the *Right* and *Left Lung*. The Right, or Larger Lung, is divided into three lobes; the Left, or Smaller, conſiſts of two lobes only.

The *Colour* of the lungs of children is of a florid red; but in adults it is livid (464).

The *Figure* of the bags containing the lungs is like that of the lungs; their baſe is broad; their anterior part is almoſt entirely flat; their external part is ſomewhat convex;

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(464) In a *fœtus* the lungs bear a leſs proportion to the reſt of the body than in an adult; they do not cover ſo large a portion of the heart, but are very ſhort, and, as it were, concealed in the ſuperior part of the thorax.

their internal is ſmooth, and their poſterior is round. The inferior extremity of the left lung is excavated, from the ſituation of the adjacent heart: the ſuperior extremity of both lungs is like an obtuſe cone.

They are connected, in a natural ſtate, ſuperiorly, with the neck, by means of the *aſpera arteria*; inferiorly, with the heart, by means of the large pulmonary veſſels. In other parts they are unconnected.

The external coat of the lungs is thin, and ſomewhat white; it is a continuation of the *pleura*. Under this coat there is a rare, cellular texture, which is always deſtitute of fat.

The internal *Fabric* of the lungs is compoſed of many ſmall lobes, joined to one another by the external coat. The Interſtices of theſe *lobuli* are filled with the cellular texture above-mentioned, through which veſſels are diſtributed. Each of theſe little lobes is compoſed of many leſs ones, which are likewiſe compoſed of others ſimilar, but always decreaſing in magnitude. The interſtices of them all are filled with cellular membrane. Laſtly, the very ſmall *lobuli* change into little membranous veſicles, which are empty in *foetus*, and collapſed; but in children after birth, and in adults are filled with air, opening into one another. The Pulmonary Artery, and the Pulmonary Veins, are diſtributed by numerous ramifications throughout the whole lungs, till the very ſmalleſt veſſels of all encompaſs each veſicle, like a net (465).

Beſides theſe large veſſels, there are ſmaller arteries belonging to the lungs, deſtined for their nutrition, which are called the *Bronchial Arteries.* Theſe ariſe from the *aorta* and intercoſtal arteries.

There are likewiſe *Bronchial Veins*, which terminate in the *vena azygos*, and intercoſtal vein.

The *Lymphatic Veſſels* form a net-like *plexus* on the ſurface of the lungs, and run to the thoracic duct.

The *Bronchial Glands*, which are blackiſh or bluiſh, are ſituated about the branches of the *bronchia* for the ſecretion of *mucus* (466).

The *Nerves* of the lungs come particularly from the eighth pair, and from the great intercoſtal nerve, and they are divided into the *Anterior* and *Poſterior Pulmonic Plexus* (467).

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(465) As to the number of the veſicles, Keil computed them as 1744000000. As to their form, it is polyhedral. —Blumenbach imagines that the lungs of an adult can contain only 60 cubic inches of air in a full inſpiration (*Inſt. Phyſ.* § 133.); but Doctor Goodwyn ſays they may contain 123 cubic inches (Exp. Inq. Sect. III.).

(466) There are alſo glands in the ſubſtance of the lungs, and the tubercle is probably a diſeaſe of them (Cruikſhank on the Abſorbent Syſtem.).

(467) The lungs, compared with other *viſcera*, have very many nerves (See Wriſberg's note 74 on § 245 of Haller's *Primae Lineae.*).

The *Uſe of the Lungs* is to form the blood, to ſerve for reſpiration, and the formation of the voice (468).

Of

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(468) The neceſſity of reſpiration has been known from the earlieſt ages, and *To live* and *To breathe* have accordingly been conſidered as ſynonymous terms.

Reſpiration, or Breathing, conſiſts of two actions, the one by which we draw air into the lungs, and the other by which we expel it from them. The former is called *Inſpiration*, the latter *Expiration*.

Reſpiration has been variouſly accounted for; but, if I miſtake not, nothing ſatisfactory has yet been offered. The neceſſity of reſpiration is a reaſon for its being, and ſuperſedes all ingenious ſolutions of it.

Reſpiration is a *vital* motion; for it continues during ſleep, and apoplexy, when the will has no power. But as we can increaſe and diminiſh, and accelerate and retard reſpiration as often as we pleaſe, there can be no doubt of the propriety of dividing reſpiration into *Vital* and *Animal*.

In the *Oſteology* we ſaw the ſtructure of the thorax, which is compoſed of the *ſternum* anteriorly, the twelve dorſal *vertebrae* poſteriorly, and the twelve ribs on each ſide, ſeven of which only come to the *ſternum*. In the *Myology* we ſaw the hiſtory of the intercoſtal muſcles, and their action; and hence we may infer what movement the ribs can undergo in reſpiration. We ſaw that the ribs are more moveable as they are farther from the firſt, which is the leaſt moveable of all: we ſaw that, when the ribs are raiſed by the contraction of the intercoſtal muſcles, their inferior margins are drawn outwards, ſo that the cavity of the *thorax* is enlarged every way, but chiefly laterally. To the enlargement of the *thorax*, the diaphragm alſo contributes, which by contracting deſcends, and lengthens the cavity.

Perhaps the thorax is more enlarged by the deſcent of the diaphragm and *viſcera* of the *abdomen*, than by the aſcenſion of the ribs, at leaſt in placid and vital reſpiration, when, if you except the two laſt, which follow

Of the Neck in general.

The parts that form the *Neck* are divided into *External* and *Internal.*

The

low the motion of the diaphragm, the ribs do not ſeem to be moved at all (Haller, *De Muſculis Diaphrag.).*

In dying animals, and when there is a neceſſity for a deep inſpiration, then other muſcles are called into action, and the ribs are raiſed very violently. Even the firſt rib is then raiſed. The muſcles which only act in difficult inſpiration are the *ſcaleni*, *trapezii*, *cervicales deſcendentes*, *ſerrati ſuperiores*, and *pectorales*, which are inſerted into the *ſcapula*, clavicles and *thorax.*

I never ſaw the *ſternum*, or its lower part, puſhed forwards in a placid inſpiration.

To inſpiration ſucceeds expiration, in which the intercoſtal muſcles and diaphragm are relaxed, and in which the capacity of the *thorax* is leſſened.

The alternate motions of reſpiration begin at birth, and continue till death; and probably the cauſe of their continuance is the cauſe of their firſt commencement. This cauſe Dr. Whytt takes to be an uneaſy ſenſation in the lungs, ariſing in conſequence of their collapſed ſtate, and the impediment to the blood's eaſy route from the right to the left ſide of the heart. The air too, which operates in ſome manner on our lungs, muſt be alternately inſpired and expired, expiration being neceſſary to compreſs the pulmonary veins, and remove the reſiſtance, which muſt otherwiſe exiſt, to the blood paſſing from the pulmonary artery.

Whether our blood attract pure air from the atmoſphere, or the oxigenous principle, and whether it communicate to the atmoſphere, in exchange, inflammable air, or one of its principles, ſince air is altered by breathing, I cannot tell. I know that pure air is neceſſary to animal life; but I take it that one of its chief uſes is to dilate the aerial veſicles, and conſequently to elon-

The *External Parts* are

1. The Common Integuments,
2. The Muſcles,
3. The Seven Cervical *Vertebrae*, and a portion of the ſpinal marrow contained within them,
4. The Eight pair of Cervical Nerves,
5. The Eighth pair of the cerebral nerves, and the great intercoſtal nerve,
6. The Two Carotid Arteries,
7. The Vertebral Arteries,
8. The External and Internal Jugular Veins,
9. The Small Glands of the Neck,
10. The Thyroid Gland.

gate and unfold the ends of the pulmonary artery, and the beginnings of the pulmonary veins.

At the end of every expiration, the blood is accumulated on the right ſide of the heart, and as it cannot then paſs freely through the pulmonary artery, its extremities being coiled up, an uneaſy ſenſation ariſes, and it is in conſequence of this that the thorax is enlarged, and that the lungs, which are paſſive, but always contiguous to the *pleura*, are opened to receive the air ruſhing through the *glottis*.

They who are deſirous of ſtudying this ſubject, with peculiar care, may conſult Kaau *Perſ. Dict. Hippoc.* Whytt on the Vital and Involuntary Motions, &c. and Haller's Great Work.

I noticed, ſpeaking of the pulſe, that Hippocrates attended little to it. I have now to remark, that the pulſe and the breathing have a mutual connection and dependence on each other; that when the one is quick or ſlow, the other is generally ſo likewiſe, and that in common there are three or four pulſations for one reſpiration. As Hippocrates attended ſo much to the breathing, we readily ſee how he compenſated his neglect of the pulſe.

The *Internal Parts* are

1. The *Larynx*,
2. The *Aſpera Arteria*,
3. The *Fauces*,
4. The *Pharynx*,
5. The *Oeſophagus*.

Larynx and Aſpera Arteria.

The *Larynx* is a hollow body, compoſed of cartilages, muſcles, ligaments and glands, and it is placed behind the tongue in the forepart of the neck. It is connected ſuperiorly to the *os hyoides* by muſcles and ligaments, poſteriorly to the baſe of the tongue by membranes, and to the *pharynx* by various muſcles.

The *Cartilages* of the pharynx are four, viz.

1. The *Cricoid*, or *Annular* Cartilage,
2. The *Scutiform*, or *Thyroid* Cartilage,
3. The Two *Arytenoid* Cartilages,
4. The *Epiglottis*.

1. The *Cricoid Cartilage* takes its name from its figure. It is narrow before, and broad behind, where it is divided by a ſpine into two excavations, in which are received the arytenoid cartilages.

It conſtitutes the baſe of all the reſt. It is joined inferiorly with the *aſpera arteria* by means of ſome ligaments and muſcular fibres, and ſuperiorly with the thyroid and arytenoid cartilages.

2. The *Thyroid Cartilage* is placed perpendicular to the cricoid, and conſtitutes the anterior, ſuperior, and largeſt part of the *larynx*. It conſiſts of two cartilaginous *laminae*, which are nearly quadrangular, uniting anteriorly in an obtuſe angle, but poſteriorly receding from each other. This Cartilage is harder, and more prominent in men than in women; hence, it is found in ſome authors under the name of *Pomum Adami*.

Poſteriorly, ſuperiorly and inferiorly it has two proceſſes, called *Cornua*. The ſuperior, ſtraight *cornua* are joined to the *cornua* of the *os hyoides* by round ligaments. The inferior ſhorter are affixed in the articular cavities of the annular cartilage, that are intended for this purpoſe. The Thyroid Cartilage is alſo faſtened to the other cartilages by ligaments and muſcles.

3. The Two *Arytenoid Cartilages* are ſeated perpendicularly behind the ſcutiform cartilage in two excavations of the annular cartilage. They are of a particular figure; their baſe is broad, and ſomewhat hollowed, and connected by moveable articulation with the cricoid cartilage. Superiorly, they are narrow and triangular. Their poſterior ſide is excavated; the anterior ſide is convex. Laſtly, they terminate in a thick ſuboval cartilage. They are ſituated from each other above and

below, but they are connected by means of many muſcular fibres; therefore the ſpace included by them may be made wider or narrower, according to the different action of theſe fibres.

Beſides, they are united with the ſcutiform cartilage by ſtrong elaſtic ligaments (which are covered by the pituitary membrane of the *larynx)*, and ariſe below the middle of the arytenoid cartilages, and run forwards in a direction almoſt tranſverſe, and are inſerted into the inſide of the lateral parts of the ſcutiform cartilage, and are loſt in its obtuſe angles.

Under theſe ligaments there are two others, which are leſs, and which ariſe alſo from the arytenoid cartilages, running forwards like the inferior ligaments, and ending in the middle of the ſcutiform cartilage. Between theſe two ſuperior and inferior ligaments on each ſide, there is a cavity, called *Ventriculus Galeni.* Superiorly and inferiorly theſe cartilages encloſe a narrow opening, in the middle, called the *Rima Glottidis.* This opening runs poſteriorly together, with a perpendicular ſpace placed ſuperiorly between the two arytenoid cartilages, and like this, may be enlarged or contracted, as the cartilages are contracted or dilated. This *Rima Glottidis*, in its natural ſtate, is always large behind and ſmall before.

The *Uſe of the Rima Glottidis* is to change the voice variouſly.

4. The *Epiglottis* is ſituated over the aperture of the *larynx*, and is named from its office (469).

Its *Figure* is nearly oval, it is concave poſteriorly, and convex anteriorly. Its apex, or ſuperior extremity, is looſely ſituated, and is always elevated upwards by its own elaſticity. While the back of the tongue is drawn backwards in ſwallowing, the *epiglottis* is put over the aperture of the *larynx*; hence it ſhuts up the paſſage from the mouth into the *larynx*. The baſe of the *epiglottis* is fixed to the *thyroid* cartilage, the *os hyoides*, and the baſe of the tongue by a ſtrong ligament.

The *Larynx* is covered all over externally by a ſubtile cellular texture, and internally by a pituitary membrane, continued from the mouth.

The *Glands of the Larynx* are all to be referred to the claſs of mucous glands, and are diſperſed not only over the whole internal coat of the *larynx*, like little grains, but alſo over the arytenoid cartilages for inſtance, where many of them cohere.

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(469) According to Leber there are five cartilages that concur to form the *larynx*, though he will only enumerate four, conſidering the two *arytenoideae* as one. Wriſberg ſays that there are nine cartilages forming the *larynx*, and he enumerates two of a ſmall ſize placed above the *arytenoideae*, but connected to them, like the *cricoidea*, by capſular ligaments. Theſe have already been called by Sanctorius the *ſixth* and *ſeventh*.

Wriſberg ſays that a few years ago he diſcovered two other bodies ſeemingly cartilaginous, lying between the *epiglottis* and the arytenoid of each ſide, but nearer the arytenoid cartilage than the *epiglottis* (Note 82 on § 294. of Haller's *Pr. Lin.*).

The *Uſe of the Mucous liquor* of theſe glands is to moiſten the parts, and keep them moveable and fit for their office.

The *Muſcles of the Larynx*, of which there are five, are ſpoken of in the *Myology*.

The *Uſe of the Larynx* is to form the voice and its various modifications; the air in reſpiration enters the lungs through the *larynx*, and paſſes back again.

The *Thyroid Gland* is noticed in the *Adenology*.

Its *Arteries* come from the ſubclavian and carotid arteries, and the *Veins* terminate in the jugulars.

This gland is filled with an aqueous, viſcid, yellowiſh liquor. Its uſe is unknown, for it is uncertain whether, or not, it have an excretory duct.

The *Aſpera Arteria* is a tube compoſed of cartilaginous, membranous rings, and muſcular fibres. It ariſes in the neck, below the annular cartilage of the *larynx*; thence it deſcends into the cavity of the *thorax*, and is there divided into two branches, which are afterwards diſtributed by leſs branches throughout the whole lungs, and by their ultimate ends conſtitute the veſicles of the lungs.

The *Fabric of the Aſpera Arteria* conſiſts of

1. *Two Tunics*; the external, which conſiſts of cellular membrane; and the internal, which is nervous, very ſenſible, having many

mucous ducts, and being covered with the *epidermis*. Between theſe coats are interpoſed

2. The *Cartilaginous Rings*, which are connected to one another by intermediate muſcular fibres. Theſe cartilages do not perfectly encloſe a circle; but their ends are united poſteriorly by ſtrong, ſtraight, muſcular fibres, which concur to form a part of the circumference.

Theſe cartilaginous rings are ſmall, but elaſtic, and ſomewhat thicker anteriorly than laterally.

The ſuperior are larger than the inferior; for they are the ſmaller, the farther they deſcend.

The muſcular fibres, which join the rings together, run not only tranſverſely, to conſtrict the *aſpera arteria*, but perpendicularly alſo, deſcending from one ring to another, to ſhorten the *aſpera arteria*. Under the latter there are other muſcular fibres, which ariſe from the annular cartilage, and deſcend poſteriorly throughout the whole *aſpera arteria*, vaniſhing at length in the lungs.

Between the internal coat and the muſcular fibres, numerous ſimple glands are placed, which pour out a pellucid, watery mucus into the hollow of the *aſpera arteria*.

The *Aſpera Arteria* is divided into two branches in the upper part of the *thorax*, oppoſite the third *vertebra* of the neck. The right branch is the ſhorter, but larger of the two, and the left is the longer, but ſmaller. The right branch belongs to the right lung, and the left to the left lung.

The Fabric of theſe branches, as far as they are without the lungs, is every where alike: but as ſoon as they are within the lungs, the cartilaginous rings change gradually into layers of an irregular form, and angles: the muſcular part, and the interpoſed membranous part, is gradually encreaſed, till at length, the ſmalleſt branches ſeem to conſiſt of mere tunics, void of cartilages, and changed into veſicles; ſuch as we have already deſcribed under the name of Pulmonary Veſicles.

The *Arteries of the Aſpera Arteria* come from the carotids: a few alſo come from the ſubclavians.

The *Veins* terminate in the jugulars.

The *Nerves* come from the recurrent branch of the eighth pair.

The *Uſe of the Aſpera Arteria* is to admit the ingreſs and egreſs of air into the lungs, in ſpeaking and breathing (470).

Of

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(470) Animals that have no lungs, have no voice. Voice, properly ſpeaking, is a ſound produced by the paſſage of air through the *glottis*, impinging againſt the *larynx*, and cauſing a vibratory motion of its cartilages.

The *glottis* is very eſſential to the voice. If the *aſpera arteria* be divided, the voice is deſtroyed, becauſe the air cannot then paſs through the *glottis*. The vibration of the cartilages of the *larynx* may be felt by applying the hand while we ſpeak.

Voice may be divided into *articulate* and *inarticulate*. This latter is already defined; but articulate voice or ſpeech differs from it in being modified by the tongue, teeth,

Of the Fauces, Pharynx, and Oeſophagus.

I.

By the term *Fauces*, we mean that large cavity, ſituated behind the tongue and ſoft palate, which ends in the *pharynx*.

It

teeth, lips, noſe, *velum pendulum palati*, &c. Voice therefore can exiſt without ſpeech, but ſpeech cannot be without voice.

It has been diſputed, whether the varieties of voice depend upon the dilatation and contraction of the *rima glottidis*, or upon the tenſion and relaxation of its ligaments? Whether the ſound of our voice is produced by the *larynx* ſerving as a pipe, or by its ligaments as muſical cords? The latter opinion was propoſed to the French Academy of Sciences by a Monſ. Ferrein, who took the thyreo-arytenoid ligaments for muſical ſtrings; the former was the opinion of Galen.

Now, that the ſtrength of the voice is in proportion to the narrowneſs of the *glottis*, and the quantity of air blown through it, is beyond doubt. But a grave ſound muſt proceed from a relaxation and dilatation of the *glottis*, and an acute ſound from its tenſion and conſtriction.

But it is not probable that the variations of the voice in ſpeaking, ſinging, &c. depend entirely upon the contraction and dilatation of the *glottis*. The length of the ligaments above mentioned, and their tenſion, ſeem to me neceſſary for the various modifications of ſound; and the experiment, in which the peculiar voice of animals is produced by blowing air into their *larynx*, while the ligaments of the *glottis* are tenſe, perſuades me that theſe alſo concur to form the voice, and are more inſtrumental in it than the mere dilatation or contraction of the *glottis*.

When air is expired without producing a vibration of the *larynx*, then a *Whiſpering* is the conſequence.

Singing

It is bounded poſteriorly by all the cervica *vertebrae*, and ſuperiorly by the *os occipitis*, and middle portion of the *os ſphenoides*; anteriorly and laterally by the ſoft palate; inferiorly by the *pharynx* and *fauces*; externally by muſcles on all ſides; and ſuperiorly and laterally by much cellular texture.

There open into the *fauces* laterally the two Euſtachian Tubes.

The whole cavity of the *fauces* is internally inveſted with a red ſpongy tunic, continued from the cavity of the mouth and noſtrils.

Its *Arteries* come from the external carotid, and eſpecially the internal maxillary.

Its *Veins* end in the internal jugular.

The *Muſcles* of the *fauces* are deſcribed in the *Myology*; and the *Bones* in the *Oſteology*.

Singing is cauſed by modulating the voice through various degrees of acuteneſs and gravity. It conſiſts of ſpeech and the harmonical change of the voice.

Speech is a peculiar modification of ſound, formed by means of the tongue, lips, teeth, &c. in which the voice is made to expreſs ſigns or letters, and words. See *Jo. Walliſii Grammatica Linguae Anglicanae, cui praefigitur de Loquela, ſeu Sonorum omnium loquelarium formatione Tract. Grammatico-phyſicus. Ed.* 6^{ta}. *Lond.* 1705. *curante Th. Hollis.*

It remains to be obſerved that, as the mobility of the *glottis* depends upon the muſcles of the *larynx*, and as theſe are moved in conſequence of the will, ſo if the *par vagum*, or the recurrent nerve be tied, divided, or compreſſed, the voice is deſtroyed. An inſtance is given, in which the throat being ſtrongly compreſſed, *aphonia* followed (*Hiſt. de l'Acad. de Paris*, 1705.): probably becauſe the recurrent nerve was compreſſed.

The *Nerves* come from the fifth and eighth pair.

The *Uſe of the Fauces* is in deglutition, reſpiration, ſpeech, and hearing, becauſe of the orifices of the tubes.

II.

The *Pharynx*, or top of the *Oeſophagus* is a fleſhy bag, in the form of a funnel, behind the *larynx*, beginning at the *fauces*, and ending in the *oeſophagus*.

Its *Fabric* is of mere muſcles, covered by the pituitary membrane of the mouth.

It coheres by means of its muſcles, with the baſe of the *cranium*, the *vertebrae* of the neck, and the *os hyoides*; as noticed in the Myology.

III.

The *Oeſophagus* is a tube as well membranous as muſcular; beginning at the *pharynx*, between the *aſpera arteria* and the cervical *vertebrae*, rather on the left ſide. It deſcends in the poſterior triangular ſpace of the *mediaſtinum* through the *thorax*, and the left *foramen* of the diaphragm, and is laſtly inſerted into the ſtomach (471).

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(471) In a living man, ſtanding upright, the *oeſophagus* correſponds to that part of the *aſpera arteria* which

It is compoſed of the following tunics; of which

1. The *Outermoſt* is continued from the *pleura.*

2. The *Muſcular*, which conſiſts of many fibres, not only ſtraight, but alſo annular, by which the *oeſophagus* is rendered ſhorter and narrower. Between theſe two orders of fibres there is cellular membrane.

3. The *Nervous.*

4. The *Inmoſt*, which comes from the *epidermis.* Between this and the preceding there are numerous mucous glands, the excretory ducts of which perforate this laſt membrane. There are two glands, which are worthy of attention, becauſe of their magnitude: theſe are placed in the region of the fourth dorſal *vertebra*, and are called the *Dorſal Glands.*

The *Uſe of the Oeſophagus.* It ſerves for the tranſmiſſion of *ingeſta* into the ſtomach.

Of the Head in general.

The *External Parts of the Head* are

1. The *Common Integuments* of the body, and the *Hair.*

2. The *Various Muſcles*, which are deſcribed in the *Myology.*

which is ſoft, ſo that it can eaſily yield when we ſwallow things. Therefore its ſituation is behind the *aſpera arteria.*

3. The *Bones of the Face* and *Cranium*, together with the *perioſteum*, concerning which we have already treated in the *Oſteology*.

The *Internal Parts of the Head* are

1. The *Hollow of the Mouth.*
2. The *Tongue.*
3. The *Noſe.*
4. The *Ears.*
5. The *Eyes.*
6. The *Brain*, and parts belonging to it.

Of the Mouth.

The Parts which ſurround the hollow of the mouth externally, are

1. The *Lips*, which are divided into *Upper* and *Under*.—Each lip is tied to the gum, in the middle, oppoſite the *Dentes Inciſivi*, by a particular ligament, formed by a duplication of the cutis, called the *Froenulum* of the Lip. In healthy perſons the lips have a grateful redneſs; becauſe they are compoſed of muſcles and very many veſſels, covered with a thin *epidermis.* Both extremities, where the lips are joined together, are called the *Angles of the Lips.*

2. The *Chin*, which is the loweſt, middle, and prominent part of the face, placed under the lower lip. In man the lips and chin are covered with the beard.

3. The *Cheeks* are fleſhy, arched parts of

the face, beginning under the eyes, and continued to the lower jaw.

As to their *Fabric*, they are formed of the common integuments, various muſcles, and the maxillary bones.

Their *Arteries* ariſe from the external carotid. Theſe arteries are, the Maxillary Artery, the *Coronary Arteries* of the Lips, the *Angular Arteries*, and many branches coming from contiguous parts.

Their *Veins*, which are named like their arteries, all end in the external jugulars.

Their *Nerves* come from the fifth and ſeventh pair; viz. The Inferior Orbital Nerve, the Labial Nerve of the Inferior Maxillary, and the *Portio dura* of the Auditory Nerve.

The *Cavity* of the mouth is terminated internally and ſuperiorly by the hard and ſoft palate, inferiorly by the tongue and muſcles under it; anteriorly and laterally by the *alveoli* and teeth; and it extends backwards to the *fauces*.

In the Mouth one may perceive

1. The *Alveolar Arches*, encompaſſed by the gums, and encloſing the teeth.

2. The *Gums*, which ſurround the *alveoli* and teeth as far as the coronary proceſs of the *maxilla*; alſo the *maxillae* internally. The gums conſiſt of a red, ſpongy tunic, of a ſingular fabric, poſſeſſed of numerous blood-veſſels.

The *Palate* is the ſuperior, arched part of the mouth. The upper jaw from before backwards, and the *uvula* mark its extent.

It is divided into the *Hard* and *Soft Palate.*

The *Hard Palate* is anteriorly compoſed of the bones of the upper jaw, covered with *perioſteum*, and the common membrane of the mouth, which membrane, eſpecially in man, forms numerous conſpicuous *rugae.*

The *Soft Palate*, or *Velum Pendulum Palatinum*, is that partition hanging from the external margin of the *oſſa palatina*, and laterally from the pterygoid proceſſes of the *os ſphoenoidale*, like a moveable *antipendium*, between the poſterior *foramina* of the noſtrils and the mouth.

This *Velum Pendulum Palatinum* is compoſed of the internal coat of the mouth and noſtrils, in which many glands and muſcles are included. It forms two arches, which deſcend on both ſides from the palate itſelf; the two anterior of theſe arches, which are ſmall, are affixed laterally to the tongue; the two poſterior, which are large, are inſerted laterally into the *pharynx*. In the middle of the two poſterior arches, the *velum pendulum palatinum* is extended into a ſmall conical body, having numerous glands. It is called the *Uvula*, or *Columella*. Betwixt both arches, and on both ſides, there is an oblong, ſuboval gland, convex poſteriorly, but rather flattened anteriorly, and thick ſuperiorly, opening into the cavity of the mouth, by twelve or more large excretory ducts. Theſe glands are called from their figure, *Amygdalae,* or *Tonſils.*

We may ſee the *Muſcles* of the ſoft palate in the MYOLOGY.

The whole cavity of the mouth is lined with a thin ſpongy membrane, conſiſting of a continuation of the *epidermis* and cellular membrane. Between theſe two, eſpecially in the *fauces* and *velum pendulum palati,* there are numerous ſmall glands, the liquor of which keeps the parts moiſt and glib.

The *Salival Glands,* which are large, and pour their liquor into the mouth, have already been deſcribed in the ADENOLOGY.

The *Arteries* of theſe parts come from the external carotid and the internal maxillary arteries.

The *Veins* terminate in the internal jugular.

The *Nerves* come from the fifth and eighth pair.

The *Uſe of this Cavity* is for maſtication and deglutition. It affords a paſſage for the air in breathing; and it is uſeful both in ſpeaking and in ſucking.

Of the Tongue.

The *Tongue* is a ſoft, fleſhy part, very moveable on impreſſion, ſituated inferiorly in the cavity of the mouth, and conſtituting the organ of Taſte.

It is divided into

1. Its *Baſe*, or poſterior part, which is connected with the *os hyoides*, and by the intervention of this to the adjacent bones and muſcles.

2. Its *Body*, or middle and larger part, which ends anteriorly in a looſe, moveable point.

3. Its *Back*, or ſuperior ſurface, on which one may obſerve the *linea mediana* running through the middle, and dividing it into two parts; alſo the *foramen coecum*, as it is called, poſteriorly ſurrounded with glands that pour forth their mucus there.

4. The *Inferior Surface*, which is connected to the parts below it by means of the *Sublingual Ligament*, or *Fraenulum*, which is a production of the *cutis*.

5. The *Two Lateral Parts*, which are connected to the contiguous parts by membranous ligaments.

The *Internal Fabric* of the tongue conſiſts of muſcular fibres, which may be ſeen in the *Myology*. All the muſcular fibres of the tongue are covered by a membrane, which is a continuation of the epidermis, of the reticular body of Malpighi, which is placed under it, and is particularly thick in this place, and the tunic of the face and mouth. But this tunic is always ſoft and humid, becauſe of the abundance of *ſaliva*, and the mucous liquor of the numerous glands placed under the ſurface of this internal membrane, as it is called. On the upper ſurface of the membrane, which is extended over the back, and particularly the apex, and two lateral parts of the tongue, one may ſee very many ſmall bodies, reſembling warts, known by the name of the *Nervous Papillae* of the Tongue.

The *Figure* of the *papillae* is various; but we are wonted to diſtinguiſh three kinds, in particular

The firſt kind comprehends the largeſt. There are about ſeven or nine on the poſterior part of the tongue ſituated around the *foramen coecum*. Their figure is like that of an inverted pyramid or cone: their root being ſmall and acute, their apex thick and obtuſe. They conſiſt of many ſmall veſſels and nerves, connected together by cellular membrane. They ſeem as if they had a ſmall perforation ſuperiorly in their middle, or were at leaſt excavated.

Another claſs of the lingual *papillae* are *fungiform*. Theſe are leſs and more delicate than the former. They chiefly occupy the middle part of the back of the tongue; they gradually decreaſe anteriorly, and at the apex of the tongue, they are placed nearer together. The figure of theſe is ſomewhat like a cylinder, terminated ſuperiorly in an obtuſe, hemiſpherical apex.

To the third claſs are referred the *Conoidal Papillae.* The broad baſis of theſe adheres to the tongue, their apex extended upwards is apparently ſmall. Theſe are more numerous than the reſt. They are principally ſeated on the anterior part of the tongue only, and its apex, where they ſeem ſomewhat inflected. Some of them are alſo placed about the *foramen coecum.*

Between all the *papillae* now deſcribed, there are placed others, filiform, cylindrical, and belonging to the ſame claſs. Theſe, as well as the former, are covered by a whitiſh, ſemitranſparent membrane, which is continued from the *epidermis*, and is never found perforated in man, as in brutes (472).

The *Arteries* of the tongue are many. The largeſt, which is called *Lingual*, or *Ranine*, ariſes from the external carotid, and runs along the under ſurface of the tongue, to its apex. Other ſmaller arteries are derived from branches of the labial artery.

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(472) Ruyſch calls this membrane *Epithelium* (*Theſ.* X. *n.* 18.), and Albinus calls it *Periglottis* (*Acad. Annot. Lib.* I. *Cap.* XVI.).

The *Veins* empty themſelves into the great lingual vein, which delivers its blood to the external jugular.

The *Nerves* come from the eighth, ninth, and fifth pair, and are deſtined for the ſenſation and motion of the tongue (473).

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(473) Without doubt, the tongue is the proper organ of taſte. For ſugar excites no taſte if applied to any other part; it excites no idea of ſweetneſs in the mind, if applied to the palate, the cheeks, the lips, or the *oeſophagus*.

Nevertheleſs, if the tongue be the proper organ of taſte, yet other parts of the mouth are not deſtitute of the ſame faculty, for the palate can diſtinguiſh *belladonna*, the *uvula pimpinella* and muſtard, and the *oeſophagus* wormwood. But the tongue can diſtinguiſh all taſtes; therefore it is properly enough called the organ of taſte. For that the tongue ſhall have been wanting, and its place ſupplied only with a tubercle, without a loſs of the faculty of taſte (Juſſieu, *Act. Par.* 1718.), only proves that Nature can compenſate the defect of one part, by ſuperadding a faculty to another.

Concerning the varieties of taſte, conſult Grew's *Anatomy of Plants*, alſo the Philoſophical Tranſactions, 1675.

It has already been ſuggeſted that the fifth pair of nerves is deſtined for common ſenſation, and that the organs of the ſenſes are particular nerves having a particular and determinate ſenſation. So that although the tongue receive nerves from the fifth pair, yet theſe nerves are only intended for the common ſenſation of the tongue, as the branches of the ſame pair in the noſe are only intended for its common ſenſation.

Boerhaave conſidered the ninth pair of nerves as the organs of taſte *(Inſt. Med. De Guſtu.)*: and it is probable he was in the right, the other nerves only ſerving for the common ſenſation of the tongue.

In taſting, the *papillae* of the tongue are erected; and unleſs they be moiſtened, we cannot taſte at all.

The *Uſe of the Tongue.* It ſerves for chewing, ſwallowing, ſucking and taſting.

The Noſe.

The Noſe is properly divided into the external prominent part, and the internal cavity.

The external, prominent part, or the noſe properly ſo called, is triangular, compoſed of various muſcles, ſuperiorly bones, and inferiorly cartilages, covered with the common integuments of the body.

Externally in the noſe, we conſider

1. The *Root*, or the ſuperior part, contiguous to the forehead.
2. The *Back*, or the middle prominence, running along it longitudinally.
3. The *Tip*, or inferior, round part.
4. The *Alae*, or *Pinnae*, which are the lateral and moveable parts of the noſe.

The Bones and Cartilages of the noſe have already been conſidered in the proper place.

There are five cartilages of the noſe, viz.

1. The *Middle*, conſtituting the cartilaginous part of the *ſeptum narium.*
2. The *Two* on each ſide of the *ſeptum*; of which the *Anterior* are inflected forwards, producing by their union the tip of the noſe: the *Alae Naſi* are formed of the two poſterior.

The inner part of the noſe is a large, hollow, deep, and irregular, formed anteriorly by means of two orifices from the *alae naſi*, and being open by two orifices poſteriorly to the *fauces*.

It is compoſed of numerous bones, and is divided by the intervention of a perpendicular *ſeptum*, partly oſſeous and partly cartilaginous, into two cavities, the capacity of which is enlarged by many acceſſory cavities of the frontal, ethmoid, ſphoenoid, and ſuperior maxillary bones, and alſo of the ſpiral *laminae* of the *concha*, and the lacrymal duct.

Theſe two cavities are covered all over with a ſoft, ſpongy, red membrane, which is cloſely attached to the *perioſteum*, and known to Anatomiſts under the name of the *Pituitary Membrane* (474).

This membrane has numerous nerves (475), which are the organs of ſmell, and veſſels ſecreting mucus. Perhaps it has likewiſe mucous glands (476).

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(474) It is alſo called *Schneiderian Membrane*, from one Conradius Schneider, who firſt deſcribed it with accuracy, and aſſerted, contrary to the opinion of the ancients, that it prepared the *mucus* of the noſe, which they believed to come from the *encephalon* into the noſe through the holes of the cribriform plate of the ethmoid bone.

(475) The nerves are radiated in ſome degree upon the *ſeptum*, and the branches at the upper part join one another. The nerves near the *antrum*, when they have reached the pituitary membrane, in their courſe to the ſuperior turbinated bone, form a very conſiderable network; and when they reach that bone, they do not go, all of them, round its convex, curvated, pendulous edge, to the concave ſide; but ſome paſſing through the ſubſtance

The

ſtance of that bone, yet immediately upon it, which is the reaſon why we find ſo many holes in that bone. Perhaps they go through the inferior turbinated bone in the ſame manner, ſince there are ſimilar holes in it (Hunter's Obſ. p. 219.).

The nerves of the fifth pair paſſing through the noſe, and ſuppoſed by Boerhaave to end there, he conſidered as the ſource of *Sneezing*, whilſt he allowed the ſenſe of *Smelling* to belong to the firſt pair of nerves. The falſity of this conjecture is obvious from the falſity of the foundation on which it reſts. For there is no branch of the fifth pair of nerves, in the noſe, coming thither from its union with a branch of the ſixth pair, as he aſſerts. Hence, if the ramifications of the fifth pair be irritated in the noſe, the irritation cannot be thence communicated to the ſixth pair, and to the great intercoſtal nerve and the *par vagum*; ſo that the organs of reſpiration to which theſe nerves go, may excite ſneezing. Beſides, if there were ſuch communication, why may it not ariſe from irritating the firſt pair of nerves; for Winſlow ſays the firſt and fifth pair communicate in the frontal *ſinus*. But, although there be no branch of the fifth pair in the noſe, that comes from the union with a branch of the ſixth pair, yet there is a twig from the ſecond branch of the fifth pair, that returns into the *cranium*, and going to a ramification of the ſixth pair, generates the large intercoſtal nerve: hence there is a communication between the fifth and ſixth pair, and the great intercoſtal; but this communication is not with the naſal branches of the fifth pair (Marherr *in* Boerh. *Inſt. Med.* § 498.). In a word, whatever impreſſion is made on a nerve, muſt be communicated firſt to the *ſenſorium*, before it can affect other nerves; unleſs the communication be made by means of a ganglion, and there is no ganglion in the noſe (See Note 330.).

(476) Schneider ſuppoſed *mucus* to be ſeparated ſolely by

The *Nerves* are almoſt naked in the noſe. The whole firſt pair of nerves is deſtined for the noſe, as well as various branches from the fifth pair.

The *Arteries* come from the internal maxillary, and the internal carotid arteries (477).

The *Veins* terminate in the orbital and temporal veins, and theſe in the internal jugulars.

The *Uſe of the Noſe.* It is the organ of ſmell. It ſerves to make ſpeech and reſpiration eaſy. Externally the noſe contributes to the beauty of the body. The hairs or *Vi-*

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the arteries of this membrane; but others have found follicles in it. Even Morgagni ſaw a *ſtratum* of glands on the ſides of the *ſeptum*: and from analogy it is certainly very probable that *mucus* is here prepared by follicles, as well as in other parts. Beſides we could ſcarcely expect a thick *mucus*, like that of the noſtrils to come immediately from capillary arteries. Perhaps, however, in the noſe it comes from glands, and in the maxillary and ſphenoid *ſinuſes* from arteries; for in theſe latter, there may be time for the abſorption of the more watery part. The uſe of the *mucus* is evidently to keep the pituitary membrane moiſt; as we find a dulneſs of the ſenſe of ſmell as often as it is dry.

(477) A bleeding of the noſe, which is often ſo ſalutary, is from an opening of a branch of the internal carotid artery, called *ethmoidal* branch. This comes from the ophthalmic on the inner ſide of the orbit. Being divided into two, one remains in the *dura mater*, and the other deſcends through the holes of the cribriform bone to the *ſeptum narium*, the ethmoid cells, the frontal *ſinus*, and *os ſpongioſum.*

briſſae in the fore part of the noſtrils, hinder inſects from entering (478).

The Ear.

Anatomiſts divide the ear into three parts, viz.

1. The External Ear, and *Meatus auditorius externus.*
2. The Cavity of the *tympanum.*
3. The Labyrinth.

I. The *External Ear* is formed of an oval cartilage, the poſterior ſurface of which is convex towards the head; the anterior part is concave, has numerous cavities, and prominent windings; each of which ſhall be now conſidered in order.

1. The *Helix* is the moſt external ridge; it ariſes above the lobule, aſcends and is curved; deſcends, and is turned downwards and inwards, being loſt in the prominent line that divides the *concha* into two.

2. The *Antihelix*, within the *helix*, is compoſed of two eminent ridges, which unite at an acute angle. Between the *helix* and *antihelix* there is an excavation called the *Scapha.*

3. The *Concha* is the cavity under the *an-*

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(478) The *Vibriſſae* come from ſebaceous glands (Marherr *in* 494. Boerh. *Prael. Med.)*

tibelix, and divided by the *belix*, as is already noticed, into two parts; the inferior of which ends in the *meatus auditorius.*

4. The *Tragus* is a ſmall, cartilaginous eminence, placed anteriorly, and connected to the anterior extremity of the *belix*. It is beſet with numerous ſmall hairs, defending, in ſome manner, the entrance into the *meatus auditorius*.

5. The *Antitragus* is a ſimilar cartilaginous prominence, but ſmaller, oppoſite the *tragus*; it is continued from the bottom of the *antibelix*, and the cavity of the *concha*.

6. The *Lobule of the Ear* is that ſoft part hanging downwards, that is ſituated between the *tragus*, *antitragus*, and the beginning of the *meatus auditorius*. This lobule is membranous, and poſſeſſed of much fat. It was formerly, as well as now, variouſly adorned.

The *Fabric* of the external ear is formed of cartilages, covered by a thin membrane, and cellular texture, in which there are numerous ſebaceous glands.

Moreover, the external ear is connected by two ligaments to the temporal bone; the anterior of which ariſes from the baſe of the maſtoid proceſs, and terminates on the foreſide of the *meatus auditorius*, and in the cartilage of the external ear; the poſterior ariſes above the maſtoid proceſs, and is affixed by its baſe to the *meatus auditorius*.

The *Muſcles of the Ear* have been deſcribed in the *Myology*.

The *Meatus auditorius* is a canal not only cartilaginous, but alſo, in adults, bony, cylindrical in the greater part of its diameter, beginning at the *tragus* and *concha*, turned inwards and ſomewhat forwards, and terminated at the *membrana tympani*. It is of greater diameter anteriorly and poſteriorly than in the middle. In infants, immediately after birth, and in the *foetus*, this canal is wholly cartilaginous, and only an imperfect bony circle adheres to its extremity, over which the *membrana tympani* is ſtretched. In progreſs of time the circle now mentioned is joined by bone with the internal part of the *meatus auditorius*; but the external and anterior part, even in adults, like the *concha*, of which it is a production, retains its cartilaginous nature. Over the whole canal is extended a thin, very ſenſible membrane, covered with *epidermis*, and affixed inferiorly to the *meatus auditorius*, by means of cellular membrane. In this cellular membrane, eſpecially anteriorly, there are numerous yellow glands, which ſecrete a thin yellow fluid, called *Ear-wax* (479).

The

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(479) *Ear-wax*, in Latin *Cerumen*, is an extremely bitter tenacious ſubſtance. It is neither acid nor alkaline. It is thin when firſt ſecreted, but it becomes thick by age, its more fluid part being abſorbed.

Ear-wax is ſpecifically heavier than water.

If it be thrown on a red-hot iron, it inflames, and burns and exhales a dark ſmoke.

From

The bony ring placed at the extremity of the *meatus auditorius*, which gradually unites with the *os petroſum*, has a groove in which a membrane is fixed that forms the bottom of the *meatus auditorius*, ſeparates it from the hollow of the *tympanum*, and is called from its ſigure *Membrana Tympani* (48).

The *Membrana Tympani* is oval, convex below the middle towards the hollow of the *tympanum*, and concave towards the *meatus auditorius*, and convex above the middle towards the *meatus*, and concave towards the hollow of the *tympanum*.

It is placed ſomewhat obliquely, ſo that the ſuperior part goes forwards, and the inferior backwards. According to the obſervation of Anatomiſts, it conſiſts of ſix *laminae*; the *firſt* and moſt external is a production of the *epidermis*, the *ſecond* is a production of the ſkin lining the auditory paſſage, the *third* is cellular membrane, in which the veſſels form an elegant net-work, the *fourth* is ſhining, thin, and tranſparent, ariſing from *perioſteum* of the *meatus*, the *fifth*

From ſome experiments of Dr. Haygarth, it appears that the oily part of ear-wax is very inconſiderable, and that its tenacity and conſiſtence are rather owing to a *mucous* or *ſlimy* ſubſtance which connects together the particles that are oily (Med. Obſ. and Inq. Vol. IV. p. 200.).

(48) There is no hole through the *membrana tympani*, as Rivinus imagined; ſo that the tranſmiſſion of ſmoke through it from the Euſtachian tube is altogether fabulous.

is cellular membrane, with a *plexus* of veſſels, like the third, and the *ſixth lamina*, which is the inmoſt, comes from the *perioſteum* of the cavity of the *tympanum*.

But although this membrane be compoſed of numerous *laminae*, yet it is very thin, is ſtretched by the *malleus* and its muſcles, and is very ſenſible, as we learn from inflammations.

The Fabric, Situation, and Senſibility of the *membrana tympani* render it fit to receive the ſonorous waves of air, which ruſh through the auditory paſſage againſt it, and to carry them farther into the internal ear.

II. The *Cavity of the Tympanum*, or the *Tympanum*, takes its name from its figure, which is like that of a drum. It is formed in the *os petroſum*. Its figure is irregularly round, ſo that its length is greater than its depth. It is ſurrounded anteriorly by the *membrana tympani*, and poſteriorly by a bony *ſeptum* in the interior part of the *os petroſum*. It is by means of this *ſeptum* that it is ſeparated from the labyrinth, or inmoſt region of the ear. This *ſeptum* is perforated with two holes, which are named from their figure *feneſtra ovalis* and *feneſtra rotunda*. The bony ſpace between the *feneſtrae* protruding into the *tympanum* is called *Promontorium*: it divides the *tympanum* into two parts.

Anteriorly and ſuperiorly the cavity of the *tympanum* is perforated by the Euſtachian tube, which we ſhall conſider more exactly anon.

Under

Under the tube there is a paſſage for the carotid artery. Superiorly and poſteriorly there are numerous cells and depreſſions. Poſteriorly the cavity of the *tympanum*, in adults, is enlarged by the contiguous cells of the maſtoid proceſs, which are not in a foetus; theſe cells help greatly to reflect the ſound. The vaſcular membrane that comes through the tube from the noſe covers the whole inſide of the *tympanum*.

There are to be conſidered in the hollow of the *tympanum*,

1. The *Four Little Bones*; the names of which are taken from their figure, viz. *Malleus*, *Incus*, *Oſſiculum ovale*, and *Stapes*. (Theſe are deſcribed in the Oſteology, as their muſcles are in the Myology: therefore it would be ſuperfluous to deſcribe them again.)

2. The *Euſtachian*, or *Auditory Tubes*; one of which ariſes in each ear, from the anterior extremity of the *tympanum*, before the promontory, by means of a bony ſemicanal; runs forwards and inwards at the ſame time, becoming gradually ſmaller in this courſe, and terminates, after perforating the *os petroſum*, in a paſſage partly cartilaginous and partly membranous, narrow at the beginning, but becoming gradually larger, as it runs forwards and inwards, and laſt of all ending in a pouch behind the ſoft palate, near the external wing of the pterygoid proceſs, by an oblique large orifice. It is through this orifice that the pituitary membrane of the

noſe, which lines the internal ſurface of the tube, enters the *tympanum.* The tube is always open: hence there is a free paſſage for air into the *tympanum*, and for humours out of the *tympanum* into the *fauces.* Modern Surgeons, in ſome diſeaſes of the ear, make injections paſs by this way (481).

The preſence of air in the *tympanum* is neceſſary for hearing.

3. The *Feneſtra ovalis* is ſituated, as obſerved before, poſteriorly almoſt in the middle of the bony *ſeptum*, above the promontory. Hence it is almoſt oppoſite the *membrana tympani.* It is covered by the baſe of the *ſtapes*, and opens into the *veſtibulum* (482).

4. The *Feneſtra rotunda* is ſituated in the inferior and poſterior part of the *ſeptum* mentioned above. It is cloſed by a proper membrane. It leads into the *cochlea.*

5. The *Chorda Tympani* is a nerve that deſcends, like a cord, through the middle of the internal ſurface of the *membrana tympani.*

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(481) The uſe of the Euſtachian tubes, Dr. Sims thinks, is to convey the ſound of our own voice to the organ of hearing, in the ſame manner as the *meatus auditorius externus* conveys to it all other ſounds. Thus he conſiders them as the principal regulator of our own voice (Memoirs of the Medical Society of London, Vol. I.).

(482) Some Anatomiſts, and the celebrated Boerhaave, ſuppoſed that the *feneſtra ovalis* is cloſed by a proper membrane (Inſt. Med. § 555. and § 556.): but this is not the caſe. The baſe of the *ſtapes* only ſtops the *feneſtra*, and is moveable in it.

It ariſes from the *portio dura* of the auditory nerve (483).

III. In the inmoſt region of the ear, which is called the *Labyrinth*, becauſe of its numerous and various windings, are obſerved the *Veſtibulum*, the three *Semi-circular Canals*, and the *Cochlea*.

1. The *Veſtibulum* is a round cavity, in the *os petroſum*, behind the *tympanum*. There are three contiguous cavities in the *veſtibulum*, the inferior of which is round, the ſuperior is elliptical, and the third is like a canal. The *veſtibulum* is entirely lined with a ſoft nervous membrane, in ſuch a manner that the membrane is kept apart from the ſides of the bone by means of a ſubtle vapour, which is gradually condenſed into a liquid. Into the *veſtibulum* are opened the *feneſtra ovalis*, the five orifices of the three ſemi-circular canals, and the paſſages of nerves and arteries.

The whole cavity is filled with water brought by a particular canal. This canal ariſes from the tranſverſe *ſinus* of the *dura mater*, paſſes through the bone, and opens by a ſpecial opening into the cavity of the *veſtibulum*, called *Aquaeductus Veſtibuli* (484).

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(483) See Note 331.

(484) Juſt the contrary is true; the *Aquaeductus veſtibuli* as well as the *Aquaeductus cochleae* ariſe from the *veſtibulum* and *cochlea*, and carry their contents into the tranſverſe ſinus of the *dura mater*. See Note 485.

2. The three *Semi-circular Canals* lie poſteriorly and ſuperiorly in the *os petroſum.*

They are formed of a hard, bony ſhell; are ſomewhat more than half a circle; are ſmaller in the middle than at the extremities; and are hollow.

They are lined internally with *perioſteum*, and filled with a nervous pulp, between both of which a moiſture is interpoſed.

The ſemi-circular canals take their name from their figure. The *ſuperior* and *interior* is placed obliquely, and forms a right angle with the *os petroſum*: the *inferior* and *hindmoſt*, which is the largeſt, is placed perpendicularly; and the *outermoſt*, which is the leaſt, is placed horizontally with the *os petroſum.* All theſe canals open into the *veſtibulum* only by five orifices; for the internal orifice of the ſuperior, and the ſuperior orifice of the inferior canal open only in one.

The interior ſubſtance of the *os petroſum* being very rare and ſpongy in *foetus*, and becoming bony by degrees in adults, and coaleſcing with the canals above-mentioned into one bone, the reaſon ſeems evident why the ſemicircular canals may eaſily be ſeparated from the *os petroſum* in *foetus*, but difficultly in adults.

3. The *Cochlea* takes its name from its figure. It is ſituated anteriorly in the *os petroſum*, before the ſemi-circular canals, in ſuch a manner that its baſe is turned backwards, but its apex forwards and outwards.

The *Cochlea* is formed of two hollow windings, like a ſnail's ſhell, and a conoidal oſſeous axis. It is divided in the middle, in its whole length, by a canal; and it is perforated in its baſe with numerous holes. The *cochlea* is divided by a *ſeptum*, called *Lamina Spiralis*, which is both cartilaginous and bony, into two ſemi-canals, called *Scalae.* The internal poſterior *ſcala* terminates in the *feneſtra rotunda*, and is called *Scala Tympani*; the anterior opens into the *veſtibulum*, and is called *Scala Veſtibuli.*

From the apex of the *cochlea* there ariſes another infundibuliform cavity, which communicates with both *ſcalae* by means of a ſmall orifice.

The *Lamina Spiralis* ariſes from the bony axis, paſſes forwards into a membrane, and is covered entirely by the internal *perioſteum* of the *cochlea.*

The *cochlea* is entirely full of water, brought by a bony canal. This bony canal ariſes from the cavity of the ſkull by a particular orifice, perforates the *os petroſum*, ends in the *ſcala tympani*, near the *feneſtra rotunda*, and is called *Aquaeductus Cochleae.* Beſides, there are diſtributed through the cavity of the *cochlea* very ſoft nervous fibres from the ſeventh pair of nerves.

The External and Internal *Nerves of the Ear* come chiefly from the ſeventh pair, go to the hollow on the internal and ſuperior part of the *os petroſum*, ſituated behind the

labyrinth,

labyrinth, which is called *Meatus acouſticus internus*, and is divided into two branches, of which the ſmaller is called *Portio dura*, the larger *Portio mollis.*

The *Portio dura* paſſes through a *foramen* inſculped ſuperiorly in the excavation before noticed of the *os petroſum:* paſſing there through a canal, it aſcends a little at the beginning, then goes ſtraight onwards, and deſcends behind the *tympanum*, and the *ſtapes*. This canal is known by the name of *Aquaeductus Fallopii.* The *portio dura* in this courſe ſends off a particular branch into the *tympanum*, aſcending between the *malleus* and *incus*, going out of the *tympanum* through a fiſſure behind the articulation of the lower jaw, and being united to the lingual nerve. The other part of this nerve goes out through the ſtylo-maſtoid *foramen*, and ſends numerous branches into the external ear, the parotid gland, a conſiderable part of the face, the temples, and the poſterior part of the head, which are joined to the three branches of the fifth pair, and to the eighth pair, and to the great intercoſtal nerve.

There come likewiſe other nerves anteriorly into the *External Ear*, beſides the *portio dura*, from the third branch of the fifth pair, and poſteriorly from the ſecond and third cervical nerve.

The *Portio mollis* is larger than the *portio dura.* It ariſes from the *medulla oblongata*, and from the fourth ventricle of the brain. It runs like the *portio dura*, to the excavation of the *os petroſum*, and under this, ſends its branches into the *veſtibulum* and *cochlea* through the ſmall *foramina* in the bottom of the excavation. The ſmall branches going to the *veſtibulum* are diſtributed through the *pia mater* and *membrana arachnoidaea*, by which the internal ſurface of the *veſtibulum* and the *ſemi-circular canals* are lined, and form with the membranes now mentioned an expanſion, by means of which the *veſtibulum* is divided into a ſuperior and an inferior part. For this reaſon, Cottunius called this expanſion *Septum nervoſum*. This celebrated man obſerves that the branches going into the *cochlea* go out through the *foramina* in the axis of the *cochlea*; and that their fibres are diſperſed throughout the *ſcala tympani* and the *ſeptum cochleae*.

The *Arteries of the External Ear* ariſe from the temporal artery, and from the poſterior artery of the external ear. The *Arteries of the Membrana Tympani* come alſo from the temporal artery. The *Arteries of the cavity of the tympanum* come from the internal carotid, from a branch of the artery of the *dura mater*, &c.

From the internal maxillary artery, there likewiſe goes a branch into the tube, and the *meatus auditorius externus*. The *Arteries of the Veſtibulum*, and of the *Semi-circular canals*, and the *cochlea*, are branches of the artery of the *dura mater*, and of the vertebral arteries.

The *Veins* are like the arteries, and end in the internal jugular veins.

Lymphatic veſſels have alſo been detected by Cotunnius running from the *veſtibulum* and *cochlea*, through a particular canal, into the cavity of the ſkull (485).

The *Uſe of the Ear* is to receive tremulous motions of the air, to carry them to the bones of the ear, and hence through all the internal parts of the ear to the brain; thus conſtituting the organ of hearing (456).

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(485) The labyrinth is filled with an aqueous fluid, ſecreted there, as in other cavities, from the extremities of arteries. When this fluid is in too great quantity, or when it is compreſſed by the *ſtapes*, it is abſorbed by the *Aquaeducts* of Cotunnus (*De Aquaeductibus Auris Humanae. Neap.* 1760.), or, as Meckel calls them, the *Diverticula* (*De Labyrinthi Auris Contentis. Argent.* 1777.); one of which ariſes from the *veſtibulum* itſelf, the other from the inferior *ſcala cochliae*, near the *feneſtra rotunda*. See note 484.

(486) The term *Sound* is uſed not only to expreſs the ſenſation, as it ariſes in the mind, but alſo the condition of the air, or of the body which is the cauſe of that ſenſation. All bodies tremble when they produce ſound; and they communicate their tremors to the air. For obtuſe bodies moving in elaſtic fluids, neceſſarily condenſe that part of ſuch fluids which reſiſts them, and rarefy that part from which they recede. Hence an undulatory motion ariſes in the fluid.

The tremors that are excited in the air by ſonorous bodies, are collected by the external ear, and conveyed through the *meatus auditorius externus* to the *membrana*

tympani.

The Eye.

The eyes in man, and moſt other animals, are placed anteriorly in the bony cavity, under the forehead, called the *Orbits*.

We may obſerve in the eye

1. The *Parts* belonging to it, and ſerving for its motion, preſervation, and perfection.
2. The *Organ of Sight*, or the *Eye* properly ſo called, or the *Bulb of the Eye*.

The Parts belonging to the eye are

1. The Eye-brows,
2. The Eye-lids, with their cartilages, the *Tarſa* and *Cilia*.
3. The *Puncta lacrymalia*, the *Lacrymal Duct*, and the *Lacrymal Sac*.
4. The *Lacrymal Gland*.

tympani. Hence tremors are excited in it, and conveyed through the little bones of the ear to the *feneſtra ovalis*, and to the water filling the whole labyrinth. Thus is Sound produced; the nerve which conſtitutes the organ of hearing being expanded throughout the labyrinth.

Now that the external ear collects the waves of the air, is evident from this, that, if it be cut off, the hearing is rendered obſcure, or if it be flattened. The reaſon of which is clearly this, that fewer ſonorous rays enter the *meatus auditorius externus*, and many even of theſe are reflected back again (Marherr, *Prael. in Boerh.* § 565.).

The whole labyrinth is filled with a watery fluid, not with vapour, as has been proved in perſons frozen to death. And that water communicates ſound is proved from the hearing of fiſhes, which was known to Ariſtotle, and of divers who hear the voice of perſons on the ſhore. Nollet and Camper have treated well on this ſubject.

5. The *Lacrymal Caruncle.*

I. The *Eye-brows* are that layer of ſhort hair lying thick upon the lower part of the *os frontis*, on the ſuperior prominent arch of each orbit. The baſe of the eye-brows adheres to the root of the noſe, the apex of the arches being towards the external *canthus.* Hence they may be drawn upwards and downwards, and they may be wrinkled by means of their muſcles (487).

Their *Uſe* is to afford a ſhade to the eye in too ſtrong a light, to defend the eye from duſt, and ſweat flowing down the forehead, and to expreſs paſſions of the mind.

II. The *Eye-lids* are two ſemilunar moveable productions of the ſkin of the face, that cover the eye. Each eye has two, a *Superior* and an *Inferior Eye-lid*; the ſuperior of which is the larger and more moveable, the inferior and ſmaller eye-lid being rather moved by means of adjacent parts, than by any proper means of its own. Where the eye-lids embrace each other, they generate an angle on both ſides: that near the noſe is the *internal* and *larger*; the oppoſite angle, which is *external*, is alſo *ſmall*, and both angles are called *Canthi*.

The external ſurface of the eye-lids conſiſts of the common integuments, which, in this place, are thin, weak, and exquiſitely ſenſible. The internal membrane of the eye-lids is thin, red, very ſenſible, and extended over the anterior part of the bulb of the eye; it is hence called *Membrana adnata*, or *conjunctiva*. Between the external and internal membrane, at the margin of the ſuperior and inferior eye-lid, is interpoſed an arched cartilaginous *lamella*, called *Tarſus*. The *Tarſus* of the ſuperior eye-lid is larger and more like an arch. The external margin of the *tarſus* is covered by the ſkin of the eye-lid, which is firm and thick at this place; and there are ſhort hairs turned outwards that ariſe from it, and interſecting one another when the eye-lids are drawn together, are called *Cilia* (458). They direct the impreſſion of the rays of light, when requiſite, and defend the eyes from inſects. On the internal margin of each eye-lid lie lengthways, ſmall, ſimple, conglobate glands, ſeparating a ſoft, unctuous matter, called *Glandulae ſebaceae Meibomianae* (459).

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(487) The eye-brow is not only moved by the *corrugator ſupercilii*, but alſo by the *orbicularis palpebrae* and the *frontalis* muſcles (Haller, *Pr. Lin. Phyſ.* § 499.).

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(458) The *Tarſi* do not extend to the moveable edge of the eye-lids; for the moveable edge is formed of the mere ſkin becoming thicker in this part. It is this moveable edge, from which the *cilia* ariſe (Zinn, *De Fab. Oculi*, *p.* 246.).

(459) The matter ſecreted by theſe glands is certainly ſebaceous and oily: it is ſometimes expreſſed in form of little worms. Morgagni has given a figure to ſhow the inſide of the eye-lid, in which there are drawn pores (*Adverſ. Anat.* I. *Tab.* 4. *Fig.* I.): and Zinn has not only given drawings of the pores, but alſo of glandular *plexus* (*Tab.* VII. *Fig.* 8, 10.).

The Eye-lids are very ſenſible, becauſe they have numerous *nerves* from the firſt and ſecond branches of the fifth pair, and from the *portio dura* of the ſeventh.

The Eye-lids have numerous *arteries* and *veins* from the adjacent parts.

The *Muſcles* of the eye-lids are deſcribed in the *Myology*.

The *Uſe of the Eye-lids.* They cover the eyes, during ſleep, defend them from duſt, and other ſmall bodies floating in the air, and from the too ſtrong rays of light.

III. *Puncta lacrymalia* are two ſmall orifices, one of which is conſpicuous in each eye-lid, at the extremity of the *tarſus*, near the internal *canthus*. From each of theſe orifices there goes downwards and ſomewhat inwards, under the ſkin, a peculiar duct; one duct runs under the *caruncula lacrymalis*, and the other over it; but they both open into a common ſac, behind the *caruncula lacrymalis*, called *Saccus lacrymalis*. This ſac is ſituated in a cavity formed of the *os unguis* and a canal of the ſuperior maxillary bone. It is lined with a firm, tendinous membrane, and with the pituitary membrane continued from the noſtrils, and it is terminated in a bony canal, called *Canalis naſalis* (490). This canal is turned

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(490) Hence tears frequently flow from the noſtrils of perſons while they cry.

In the lacrymal ſac there is a proper ſecretion, inde-

pendent

rather backwards, and deſcends into the noſtrils, opening into them, under the inferior conchiform bone.

Uſe. All theſe ducts ſerve to carry the tears into the noſtrils.

IV. *Glandula lacrymalis* is a hard, conglomerate gland, ſituated in a cavity of the *os frontis*, within the orbit, above the external *canthus*. There deſcend from the lacrymal gland on the inſide of the *tunica adnata* of the eye-lid ſix or more excretory ducts, perforating the *tunica adnata* by ſo many orifices at the diſtance of a few lines from the *tarſus*, and evacuating a ſaline, aqueous fluid, called the *Tears*, between the eye-lid and the bulb of the eye. Beſides, the extremities of very ſmall arteries, exhale a moiſture from the whole ſurface of the *tunica conjunctiva*, which mixed with the liquor of the lacrymal gland and the *ſmegma* of the Meibomian glands, moiſtens and lubricates the eye, and the inſide of the eye-lids (491).

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pendent of the tears carried there through the lacrymal ducts. This is proved, I think, by reaſon and experiment.

(491) The excretory ducts of the lacrymal gland do not communicate with one another.

When we cry, we may ſay that *Tears* flow down our cheeks; but we never cry unleſs from grief, or ſome ſudden affection of the mind. Nevertheleſs, the liquor of the lacrymal gland is continually effuſed in a quantity ſufficient to moiſten the bulb of the eye, and the concavity of

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V. *Caruncula lacrymalis* is a long tubercle, conoidal and red externally, ſituated in the internal *canthus*, before the union of the eye-lids.

It is formed of a folding of the internal coat of the eye-lids, and it has numerous ſebaceous glands from which many ſmall hairs grow (492).

Uſe.

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the eye-lid ; and we alſo call this *Tears*, though it does not run over the cheeks.

The *Orbicularis* muſcle does not emulge the lacrymal gland ; for unleſs there be ſome local excitement, or ſome mental affection, the action of the *orbicularis* muſcle does not, in the leaſt degree, affect the ſecretion of tears.

The tears are determined to the internal *canthus* in the following manner. 1. The edge of the eye-lids is oblique, the external integuments being extended further than the internal membrane; ſo that, when the eye-lids are drawn together, their edges do not touch in every part of their ſurface, but only in that part which is moſt diſtant from the *cornea*, forming thereby a triangular cavity that extends acroſs the bulb of the eye, from the external to the internal *canthus*. By winking, which is performed by the *orbicularis palpebrarum*, the tears are propelled as well from the upper as the under eye-lid, towards this triangular cavity. But the *orbicularis* muſcle ariſes from the internal *canthus*, and when it acts, the external is drawn towards the internal *canthus*. Conſequently, the tears are likewiſe propelled towards the internal *canthus*. 2. Again, the tears are determined to the internal *canthus* by its being placed lower than the external. And laſtly, 3. the eye-lids unite in the external *canthus* at an acute angle, but they do not even come together in the internal *canthus*, ſo that there is leſs reſiſtance in this.

(492) There is a part of the tears that are detained by the hairs of this *caruncula*, which, together with the

ſmegma

Uſe. It keeps the eye-lids apart in the *canthi*; its glands ſeparate a lubricating fluid in that part of the eye-lids, where there are no *glandular Meibomianae*, and it directs the tears into the *puncta lacrymalia.*

Of the *Bulb of the Eye* we may notice

The *Bulb* itſelf, which is placed in a bony cavity, in the ſuperior part of the face, formed of ſeven bones deſcribed in the *Oſteology*. Between the bulb and the cavity there is a large quantity of fat, together with the muſcles of the bulb, which are mentioned in the Myology.

The *Figure of the bulb* is globular.

Its *Fabric* is formed of numerous *tunics* and *humours* included in them.

Its *Tunics* are the following,

1. The *Sclerotica*, which is ſo called from its hardneſs. It is the moſt external coat; it is white, denſe and tenacious. It is thicker poſteriorly than anteriorly. It has an aperture anteriorly, in which there is another very tranſparent, circular tunic, more convex than the *ſclerotica*, but affixed to it on all ſides, and conſiſting of numerous *laminae*; it is called *Cornea* from its tranſparency. The *Cornea* is thick, ſtrong and inſenſible, and

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ſmegma of the Meibomian glands, and other foreign matters, grows hard, and is ofteneſt obſervable in the morning.

Morgagni imagines the glands of this caruncle to be of the ſame kind as thoſe of Meibomius, i. e. ſebaceous (*Adv. Anat.* I. § 12.).

fitted by its tranſparency to convey the rays of light to the inmoſt centre of the eye (493). Between the *laminae* of the *cornea* there is always a tranſparent watery fluid, exhaled through particular pores, and abſorbed again through others (494).

This tunic, and the anterior part of the *ſclerotica* is covered by the *tunica adnata*, a production of the internal membrane of the eye-lids, and between both there is a cellular membrane very full of red and tranſparent veſſels, which is the ſeat of moſt *ophthalmiae.*

Another coat of the eye is placed under the *ſclerotica*, and is called *Choroidea:* it is affixed to the *ſclerotica* by numerous intervening veſſels. The internal ſurface of the *choroidea* is particularly called *Membrana Ruyſchiana,* Ruyſch having conceived that the *choroidea* is compoſed of two *laminae* (495).

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(493) Moſt of the French give only one name to the *ſclerotica* and to the *cornea:* what we call the *cornea,* they call *cornea tranſparens,* to diſtinguiſh it from what we call *ſclerotica,* which they accordingly call *cornea opaca.*

Zinn declares that he could never ſeparate the *ſclerotica* from the *cornea,* that he could never tell where the one ends, and where the other begins. Hence, he does not doubt but that the *cornea* is a real continuation of the *ſclerotica.*

(494) The *cornea* has veſſels, without doubt, by which the fluid between its concentric *laminae* is depoſited. But they are extremely ſmall, and carry no coloured liquor. Has any one ever diſſected the nerves of the *cornea?*

(495) Ruyſch divided the *choroides* into two *laminae,* giving the name *Ruyſchiana* to the internal, and leaving

The *Choroidea* conſiſts of numerous very ſmall arteries and veins (496); it paſſes forwards with the *ſclerotica* to the beginning of the *cornea*, where it adheres to the *ſclerotica* by means of cellular membrane in the form of a white fringe, called the *Ciliary Circle.* It then recedes from the *ſclerotica* and *cornea*, and from the ciliary circle, and goes ſtraight downwards and inwards, forming a round diſk, of which the anterior ſurface is called *Iris*, becauſe of its various colours, and the poſterior *Uvea*, from its black colour (497). The *Uvea* we before called *Membrana*

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the old name *choroides* for the external *lamina* only (*Theſ. Anat.* II. *Tab.* I. *F.* 9.). Albinus, Haller, and Zinn deny that the *choroides* is a double membrane; they tell us that the *Membrana Ruyſchiana* can never be ſeparated in man from the *choroidea*, and further that the veſſels of both are ſo blended one with another as to prevent any ſeparation. Hence the *choroides* may be accounted a ſimple membrane; but the name *Ruyſchiana* is retained by Haller, to denote the black ſurface of the choroides (*Pr. Lin. Phyſ.* § 512.).

(496) This membrane is ſo full of veſſels, that, when injected, it ſeems as if it were painted. If it be viewed through a lens, you will diſtinguiſh two orders of veſſels, one on the outſide, the ſmall veſſels coming from the larger, forming ſtars, which are the *vaſa vorticoſa*; another on the inſide, or *membrana Ruyſchiana*, the veſſels running forwards parallel to one another. It was this that led Anatomiſts to believe the *choroides* conſiſts of two membranes.

(497) The *Iris* is certainly convex towards the *cornea*, and narrower towards the noſe than towards the temples.

Silveſter O'Halloran ſays that the convexity of the *iris* *brana Ruyſchiana.* The diſk has a *foramen* in its middle, called the *Pupil,* which under different circumſtances is contracted and dilated.

In the *Iris* there are numerous large and ſmall *ſtriae,* of different colour in different men, running like rays from the external margin of the *iris* to its internal and ſmall edge, and dividing there into two branches, which unite about the pupil into a circle, from which other ſimilar *ſtriae* paſs into the external margin of the pupil. Theſe *ſtriae,* and the circle above-mentioned, have been taken by moſt Anatomiſts for muſcular fibres, dilating and contracting the pupil. When the pupil is contracted, all the *ſtriae* are ſtraight; when it is dilated, the *ſtriae* are drawn into ſerpentine folds (498).

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iris follows nearly that of the *cornea tranſparens,* and is occaſioned by the protuberance of the cryſtalline (Tranſ. of the Royal Iriſh Academy, 1788.).

(498) Silveſter O'Halloran, as well as Marherr, aſſerts that the *iris* is truly muſcular, and diſtinct from the *choroides.* He ſays it is convex, and that the inſide of the *ligamentum ciliare* is evidently fleſhy. According to him, the firſt range of fibres on the inſide of the *iris,* in man, is about the breadth of a line; and this phalanx is cloſed by a kind of tendinous narrow and circular band. From hence proceeds another row, ſmaller than the former, but like them radiated. And that part of the *iris* which forms the pupil is ſtill finer than the laſt, and free from any adherence; hence its contraction and dilatation in proportion to the vicinity or diſtance of objects. He denies that the *iris* has any circular fibres, as thoſe alluded to in the text,

The poſterior ſurface of the *choroides*, or the *Uvea*, is covered with a black ſubſtance eaſily waſhed off. But the *ſtriae* may be ſeen, when it is waſhed off, running as on the *iris* towards the pupil.

Behind the *uvea*, there ariſe out of the *choroides* from the ciliary circle before mentioned, white complicated *ſtriae*, covered with a black matter, and running from hence backwards, firmly attached to the very thin membrane of the vitreous humour, where it is inſerted into the cryſtalline lens. The fluctuating extremities of the *ſtriae* are ſpread abroad even to the cryſtalline lens, upon which they lie, but are not affixed. Taken together they are called *Ligamentum ciliare* (499); but apart

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text, and deſcribed by Ruyſch, but ſuppoſes, like Leber, that they are all radiated.

Profeſſor Blumenbach, though he does not infer, like Haller, that the motion of the *iris* depends upon an influx of fluid into its veſſels, yet he denies that the *iris* is muſcular, or endued with irritability. He ſays that the motion of the *iris* is not changed when that of the heart is; and finally, he derives the motion of the *iris* from its *vita propria (De Oculis Leucaethiopum et Iridis motu Commentatio. Goettingae*, 1786.).

The natural ſtate of the pupil is its dilatation, or retraction. Blumenbach ſays that when the eye-lids of a child, ſoon after birth, are opened, during ſleep, the pupil is cloſed up, but is ſuddenly opened, when the child awakes. The expanſion of the *iris*, during ſleep, in the *mammalia*, he attributes to cuſtom. See Note 500.

(499) In the ſpace between the ciliary circle and the edge of the *cornea*, and between the two roots of the ciliary

apart they are called *Ciliary Proceſſes.* According to the moſt recent obſervations they ſeem to be formed of the very ſmall veſſels of the *choroides.* Their *Uſe* ſeems to be to fix the cryſtalline lens, and to render viſion clear, by abſorbing the lateral rays of light.

In *Foetus* there is another membrane, very thin, and of an aſh-colour, ariſing from the internal margin of the *iris*, and totally covering the pupil; hence called *Membrana pupillaris* (500).

The *third*, and inmoſt coat of the eye, is called *Retina.* It is an expanſion of the pulp of the optic nerve, having very numerous veſſels. It ariſes poſteriorly from the optic nerve; its poſterior ſurface which is entirely pulpy, adheres to the *Membrana Ruyſchiana*, its anterior or internal is compoſed of more veſſels, lies immediately upon the vitreous ſubſtance, paſſes forwards to the *ciliary ligament*, and adheres to it. From hence, as ſome think, it goes to the lens, and is affixed to its edge.

The *Retina* is the true organ of viſion (501).

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ciliary ligament, there is a triangular canal, which was firſt diſcovered by Fontana (*Sur le Venin de la Vipere, Vol.* II. *Tab.* VII. *Fig.* 8. 9. 10.), and ſince by Adolph. Murray (*Nova Act. Upſal. Vol.* III.).

(500) See Note 448. Its uſe, ſays Blumenbach, is to keep the *iris* expanded while the bulb of the eye encreaſes rapidly; ſo that it renders the future motion of the *iris* more orderly. The interior circle of the *iris*, according to Blumenbach, is formed by the retraction of the veſſels of the *membrana pupillaris* (*Inſtit. Phyſiologiae.* § 259.).

(501) See the Neurology.

The *Humours* of the Eye. The *watery* humour, called ſo from its fluidity; the *vitreous* humour, called ſo from its firmneſs, and the *cryſtalline lens*, called ſo from its figure and tranſparency.

1. The *Aqueous Humour* is very fluid, and tranſparent, filling the great interſtice between the *cornea* and the pupil, and alſo the ſmall triangular ſpace extending from the *uvea* to the *lens*. Theſe interſtices are called by ſome the *Chambers of the Eye*; the former and larger is called *Anterior*, the latter and ſmaller is called the *Poſterior Chamber* of the eye.

This humour is like water. When it is loſt, it is eaſily repleniſhed. It freezes in extreme cold.

2. The *Vitreous Humour*, or rather the *Vitreous Subſtance*, or *Vitreous Body*, is a ſoft, round, tranſparent body, filling the whole hollow ſurface of the *retina* almoſt to the *uvea*, and conſequently the greateſt part of the eye. Anteriorly there is a cavity in the vitreous humour in which the cryſtalline lens lies.

It is compoſed of numerous cells opening into one another, the interſtices of which are full of a tranſparent fluid like water, but ſomewhat thicker. When this humour is wanting in large quantity, it is never again reſtored.

The vitreous ſubſtance is externally ſurrounded by a very thin, tranſparent membrane, called *Membrana hyaloidea*. This membrane is divided where the ciliary ligament lies upon the vitreous humour, into two *laminae*; the anterior of which, having left the poſterior, goes from the vitreous ſubſtance, paſſes over the external edge of the lens, and adheres to the margin of this lens, above the external edge, on the anterior convex ſurface. Some Anatomiſts call it the *Ciliary Zone*. The *Poſterior Lamina* of the *tunica hyaloidea* does not run along with the preceding, but remains united to the vitreous body, and deſcends forwards, over this body, to the poſterior ſurface of the lens, and is connected to the proper membrane of the lens at that place.

Anteriorly, between theſe two *laminae*, where the anterior ſeparates from the poſterior, there is a triangular cavity naturally containing a moiſture, which is called from its inventor *Canalis Petitianus*.

The *Arteries* of the vitreous humour come from the central artery of the *retina*.

The *Uſe* of the vitreous humour is to refract the rays of light, to convey them, when united to the poſterior part of the eye, and to keep the tunics of the eye expanded.

3. The *Cryſtalline Lens*, ſo called from its figure and tranſparency, is a ſolid body like ice, and accordingly not to be placed among the humours properly ſo accounted. It is ſituated anteriorly, directly oppoſite the pupil, in a ſphoeroid cavity of the vitreous humour, and it is annexed to the vitreous humour, as already obſerved, by means of the *tunica hyaloidea*, which ſurrounds it. Like a lens, it has two convex ſurfaces, the anterior

of which is flat, the poſterior convex. In a *foetus*, and in children recently born, the cryſtalline lens is almoſt ſpherical; but in adults it is rather flat. It is encloſed in a proper tunic, which is ſtrong, thick, and diaphanous, and covered poſteriorly by the *tunica hyaloidea*, but in no place grown to the lens. This is called the *Capſule of the Cryſtalline Lens.*

The Cryſtalline Lens is formed of numerous tranſparent *laminae* laid one upon another, and being cloſer to one another as they are more inwards, and joined together by very ſmall cellular filaments. Between theſe *laminae*, there is a watery humour.

The Cryſtalline Lens naturally, and in young people is very tranſparent, and colourleſs. In old perſons it is ſometimes yellow; this colour firſt appearing at the center, and extending by degrees to the circumference. The ſame happens when it is rendered opaque, and in the Cataract, the ſeat of which is in the cryſtalline lens.

Poſteriorly there goes into the cryſtalline lens an artery, which is a branch of the central artery of the *retina*, and it goes out from the axis of the vitreous humour. There are alſo ſmall branches of the ciliary ligament.

Uſe. The rays of light are more refracted in the cryſtalline lens than in the aqueous humour, and they are conveyed from it to the vitreous humour.

The *Arteries of the Eye* are the following, viz.

1. The *Ophthalmic Artery*, which ariſes from the internal carotid, and is diſperſed through the eye-lids, the lacrymal gland, the muſcles of the eye, and the *tunica choroidea.*

2. The *Central Artery of the Retina*, which is a branch of the ophthalmic, going into the pulp of the optic nerve, and diſappearing in ſmall ramifications in the *retina.*

3. The *Ciliary Arteries*, which alſo ariſe from the ophthalmic, and are diſtributed through the *tunica choroidea* and *uvea*, where they form a circle near the ciliary circle.

The *Veins* come, all of them, into one trunk, called the *Ophthalmic Vein*, and this goes to the external jugular.

The *Optic Nerves*, diſtributed entirely in the *retina*, conſtitute the true organ of ſeeing. They are the ſecond pair of nerves. They do not enter the axis of the eye, but enter it laterally through an opening called *Foramen opticum.*

The *Ophthalmic Branch* is the firſt branch of the fifth pair. But various branches come from the third, fourth, and ſixth pair, which are not only diſtributed through the eye, but alſo through the parts belonging to the eye.

It remains, however, for us to notice the *Ophthalmic Ganglion*, which is formed of the union of a branch of the ophthalmic nerve, another branch of the third pair, and another of the optic.

The *Uſe of the Eye* is to receive the rays of light, to refract them, and to unite them into a *focus.* Conſequently to have external objects painted on the *retina*, and the idea of them excited in the mind (502).

In men, whoſe *cornea* and cryſtalline *lens* is more convex than ordinary, the rays of light are ſooner refracted; hence they are ſooner united: but they ſeparate from one another afterwards, and impinge againſt numerous points of the *retina.* This is the reaſon that ſome men only ſee objects near to them. Such perſons are called *Myopes*, or *Short-ſighted*; and they are relieved by concave glaſſes. On the contrary, if the *cornea* and *lens* be flatter than common, the rays of light are not refracted as they ought to be, ſo that the perſons can only ſee objects at a diſtance. Theſe are called *Preſbyopes*, or *Long-ſighted*, and their remedy is a tube lined with black, or a convex lens.

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(502) To learn the properties of light, &c. the ſtudent may conſult Prieſtley's Hiſtory and Preſent State of Diſcoveries relating to Viſion.

The Aqueous Humour of the Eye has been deſcribed as a *meniſcus*, as has alſo the Vitreous Humour. But the Cryſtalline Lens was deſcribed as a double-convex, its convex ſurfaces being embraced by the concavities of the aqueous and vitreous humours.

It is by theſe humours, as *media*, that the rays of light proceeding in right lines from luminous bodies are refracted, and made to croſs one another in their paſſage to the *retina*. And, as in a *Camera obſcura*, when the rays have croſſed one another, and diverged, they form the images of the objects we look at on the *retina*. But their images are inverted on the *retina:* their right ſides are painted on the left, &c.

Thus it is the eye by means of which the mind ſees. For if the Eye itſelf ſaw, then it would ſee all things inverted, &c. (Reid's Inquiry into the Human Mind.).

But there being a diſtant image on the *retina* of each eye, it has been aſked, why we do not ſee double? The Count de Buffon, anſwers that, in reality, we do ſee all objects double, but by habit we conceive them to be ſingle (Natural Hiſt. Vol. 3. page 7. Smellie's Tranſlation.).

Of the Membranes of the Brain.

The brain is covered externally by a bony covering, which in a *foetus* is very thin, and extenſile, but in an adult, thick and firm, defending the contained brain from injury.

The *Bones*, of which the covering is made, are enumerated in the *Oſteology*.

But, beſides the bony covering, the following membranes are alſo coverings of the brain, viz.

1. The *Dura Mater*,
2. The *Arachnoidea*,
3. The *Pia Mater*.

1. The *Dura Mater*, or *Dura Meninx*, is a ſtrong, firm, inſenſible membrane, not irritable, compoſed of cellular texture, ſituated under the *cranium*, and formed of two *laminae*. The external *lamina* lines the whole inſide of the *cranium*, and is every where firmly attached to it, eſpecially at the ſutures, ſupplying the place of *perioſteum*. The internal *lamina*

is connected to the external in many places; in ſome places, however, they are at a diſtance from each other. The internal *lamina* of the *dura mater* forms various productions, or proceſſes; of which the following are the chief:

1. The *Falciform Proceſs* which ariſes anteriorly from the *os ſphoenoides*, from the *criſta galli*, from the whole of the ſagittal ſuture, and the middle of the *os occipitis*, is narrow before, but broad behind, and terminating at laſt in a point. It paſſes under the great hemiſpheres of the brain, and is united by its lowermoſt acute margin to the *ſeptum medium* of the brain.

In the *falx*, and through the reſt of the *dura mater*, there are numerous white tendinous fibres, conſpicuous, but having no irritability.

2. The *Septum tranſverſum*, or *Tentorium Cerebelli*, which ariſes from the inferior ſpine of the *os occipitis*, runs horizontally forwards, and is implanted on each ſide in the frontal ſpine, and in the poſterior ephippial proceſſes of the *os ſphoenoides:* hence it ſeparates the brain from the *cerebellum.* It is perforated in the middle by the *foramen ovale*, through which, and the great occipital *foramen* the *medulla oblongata* goes out of the *cranium.*

3. The *Septum Cerebelli* is ſomewhat like the *falx* of the brain, but ſhorter. It ariſes from the middle of the occipital ſpine, and terminates at the great occipital *foramen*, dividing the *cerebellum* perpendicularly into two principal parts.

4. The *Two Lateral Proceſſes.*

The External *Lamina* of the *Dura Mater* at laſt goes out at all the *foramina* of the *cranium*, forming as many proceſſes as there are *foramina*; to which I think it ſuperfluous to give particular names.

The *Uſe* of theſe different *Septa* is to defend the brain, leſt one part lie upon another, and compreſs it.

The *Sinuſes* of the *dura mater*, into which the veins of the brain and its membranes open, are next to be noticed, viz.

1. The *Longitudinal Sinus.* This cavity is not round, but triangular. It ariſes anteriorly from the *criſta galli*, aſcends and paſſes between the *laminae* of the falciform proceſs, to where this proceſs ends. It then unites with the *ſeptum tranſverſum*, and opens into two lateral *ſinuſes.*

2. The *Right* and *Left Tranſverſe Lateral Sinuſes*, which lie in the crucial ſpine of the *os occipitis.* The *Right Tranſverſe Lateral Sinus* is in general larger than the left. It paſſes in a peculiar *ſinus* of the *os occipitis* and *oſſa temporum*, tranſverſely at the beginning, but in a winding direction downwards to the *foramen lacerum*, or *jugulare.* At this place, it becomes larger by far, becauſe it receives two other *ſinuſes*, v. g. the inferior petrous, and the occipital *ſinus.*

The *Left Tranſverſe Lateral Sinus* is commonly leſs than the right. It opens, like the right, into the jugular vein of the ſame ſide.

It receives the fourth *ſinus*, which is deſcribed a little forwards, and the occipital *ſinus* of its own ſide.

3. The *Inferior Longitudinal Sinus* is ſmall, ſituated at the acute inferior margin of the *falx*. It receives ſome veins from the *falx*, and many that ariſe from the brain and *corpus calloſum*. It evacuates itſelf by means of ſmall veins into the fourth *ſinus*.

4. *Torcular Herophili*, or the *Fourth Sinus*, ariſes where the *falx* and *ſeptum tranſverſum* unite. It runs poſteriorly between the *laminae* of the *dura mater*, receives the blood returning from the *corpora ſtriata*, the *plexus venoſus*, the *ſeptum lucidum*, and other parts of the brain; and empties the greater part of it into the left tranſverſe *ſinus*, or into the right, or, as it ſometimes happens, into both at once.

5. The *Four Petrous Sinuſes*: a *ſuperior* and an *inferior* on each ſide.

The *Superior* ariſes commonly at the anterior extremity of a furrow in the *os petroſum*, paſſes in it poſteriorly, and is inſerted either into the tranſverſe *ſinus*, where this paſſes downwards, or into the inferior petrous *ſinus*. It receives the blood returning from veins of the *dura mater*, and anterior part of the brain.

The *Inferior* is placed at the root of the *os petroſum*. It is joined near the poſterior ephippial proceſſes to its fellow of the oppoſite ſide to the *ſinus cavernoſus*, and the ſuperior

rior petrous *ſinus*. It receives veins from the *dura mater* alſo, and empties itſelf into the tranſverſe *ſinus*.

6. The *Anterior* and *Poſterior Occipital Sinuſes*.

The *Poſterior* receives the inferior and poſterior veins of the *dura mater*, and alſo ſome that return from the *vertebrae* of the neck. In the falciform proceſs of the *dura mater*, it unites into one with its fellow from the oppoſite ſide; and it ends with it by a common orifice; but ſometimes by two orifices in the tranſverſe *ſinus*.

7. The *Anterior Occipital Sinus* ariſes from the preceding, deſcends to the great occipital *foramen*, and opens into the two inferior petrous *ſinuſes*. A branch of it is ſometimes implanted in the vertebral vein.

8. The *Two Cavernous Sinuſes*, one placed on each ſide near the *ephippium*. Their internal fabric is made up of cellular texture filled with blood. They communicate with the ſuperior and inferior petrous *ſinus*, and with the anterior occipital *ſinus*. Various veins of the brain open into them: and ſometimes the ophthalmic vein opens into them.

Through each cavernous *ſinus* runs the internal carotid artery, and the third, fourth, and ſixth pair of cerebral nerves.

Moreover, it is to be obſerved, that the great intercoſtal nerve ariſes at theſe *ſinuſes*.

9. The *Sinus rotundus*, which interiorly ſurrounds the whole of the *ephippium*, conſiſting of a cellular texture filled with blood, and encompaſſing the pituitary gland. It is joined with the ſuperior petrous *ſinuſes*, and with the anterior occipital *ſinus*. It receives the veins of the *os ſphoenoides* and of the pituitary gland.

All the *ſinuſes* mentioned are true veins, and differ from other veins only in this, that they lie between the *laminae* of the *dura mater*, adhere to the *dura mater*, and are much more robuſt than common veins. Beſides,. ſome of the *ſinuſes* are triangular rather than cylindrical.

Their *Uſe* is to convey the blood of the brain into the internal jugulars, and other veins, by the intervention of various branches going out through the *foramina* of the ſkull. Beſides, as they communicate with one another ſo often, they afford a ready paſſage to the blood in congeſtions of the brain from ſinging, blowing muſical inſtruments, &c. which could not have been done ſo well by common veins.

The *Arteries of the Dura Mater*. The *Anterior* come through the ſupra-orbital fiſſure; the *Middle*, which ariſe from the carotid artery, go through a proper *foramen* in the *os ſpoenoides*; and the *Poſterior* come from the vertebral arteries.

Veins of the dura mater, which are numerous and ſmall, end in the *ſinuſes*, and the *ſinuſes* in the jugulars and ſometimes alſo in the vertebrals.

Moreover, it muſt be noticed, that under the *dura mater*, eſpecially at the ſuperior longitudinal *ſinus*, there are many ſmall, oval glands, the uſe of which is unknown. They are called *Glandulae Pacchionae.*

Nerves of the dura mater have never been detected (503).

2. The *Tunica Arachnoidea* is another membrane that envelopes the brain. It is very thin, ſimple, and tranſparent, lying between the *dura* and *pia mater.* It adheres by means of cellular membrane to the veſſels under it, and to the *pia mater*; but it never accompanies the *pia mater* into the interſtices of the brain, but always runs over it.

It may eaſily be ſhown by blowing in air.

3. The *Pia Mater* is the third covering of the brain. It is compoſed of thin, tranſparent cellular texture, but ſomewhat denſe, receiving numerous branches going to the brain from the carotid and vertebral arteries, together with veins. It is under the *arachnoides*, covering the brain in all its convolutions and

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(503) Some have ſaid that the *dura mater* has nerves from the fifth and ſeventh pair. But neither Wriſberg (*Obſ. Anat. de Quinto Pare Nervor. Goet.* 1777,), nor any modern acknowledges them. And Haller, Hunter, and others of the moſt extenſive obſervation will not allow that the *dura mater*, or the *pia mater*, or the tendons, cartilages, ligaments, membranes, or *perioſteum*, has any ſenſibility.

interſtices, and the whole ſpinal marrow (504).

Uſe. Theſe coverings ſerve to encloſe the brain, to ſuſtain the veſſels running into it, and to accompany them.

Of the Brain.

The whole *nervous ſyſtem* is divided into

1. The Brain,
2. The *Cerebellum*, and
3. The *Medulla oblongata*; which are contained within the ſkull.
4. The Spinal Marrow, encloſed in the *vertebrae*,
5. The Nerves and *Ganglia*, which ariſe from the four parts above-mentioned, and are extended over the whole body.

The *Brain* fills the ſuperior part of the *cranium*, and is divided into two oval hemiſpheres, the right and left, in which there are three ſurfaces. The *ſuperior ſurface* is convex, the *inferior* is unequal, and *that* on each ſide is ſmooth.

Each *Hemiſphere*, on its inferior, unequal ſurface, is divided into three ſmall lobes, viz. the *anterior lobe*, lying in the coronal *foſſa*;

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(504) The veſſels of the *pia mater* penetrate the cortical ſubſtance of the brain, ſo that when the *pia mater* is ſeparated from the brain, its external ſurface is very ſmooth, but its internal ſurface is villous (B. S. Albinus, *Annot. Acad. L.* I. *Tab.* II. *Fig.* 1—5.).

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the *middle lobe*, between the *os ſphoenoides* and the temporal bone, in a *foſſa*; and the *poſterior lobe* lying upon the *ſeptum tranſverſum*, that covers the *cerebellum.*

The brain conſiſts of a double ſubſtance; the one *cineritious*, called the *Cortical Subſtance*, the other, which is internal and white, called the *Medullary Subſtance* (505).

The *Cortical Subſtance*, which is of an aſh colour, and verging upon red, is very ſoft, and compoſed of numerous very ſmall veſſels, carrying blood, and other liquors. It ſurrounds the medullary ſubſtance, which ſeems to be a production of it, and adheres firmly to it.

Upon the ſurface of the cortical ſubſtance there are numerous irregular, winding excavations and eminences.

The *Medullary Subſtance* is white and ſoft, under the cortical ſubſtance, conſiſting of numerous ſoft veſſels, and white fibres, very ſmall tender, ſoft, and parallel one to another. The medullary ſubſtance increaſes inwards, and runs inferiorly into a maſs, connecting the two hemiſpheres, and called *centrum ovale*, becauſe Vieuſſens ſuppoſed all the medullary fibres to unite in one centre at this place.

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(505) According to Sömmerring there is a third ſubſtance of a whitiſh colour between the other two, eſpecially in the *arbor vitae* of the *cerebellum*, and in the poſterior lobes of the brain (Sömmerring, *De Baſi Encephali.)*. The proportion of cortical ſubſtance to the medullary is greater in infants than in adults; for it decreaſes as age advances (Malpighi, *De Cerebri Cortice*, &c.).

This middle white medullary part joining the two hemiſpheres of the brain, and coming into view under the *falx*, when the hemiſpheres are drawn from each other, is called *Corpus calloſum*.

On the ſurface of this are conſpicuous two white parallel *ſtriae*, and many tranſverſe *ſtriae*. Anteriorly, the *corpus calloſum* is narrow, and joined to the anterior *crura* of the brain: poſteriorly, it is wide, and joined to the inferior *cornu* of the anterior ventricle, and to the *hippocampus* and parts under it.

Under the *corpus calloſum* there is a body called the *Fornix*, which is medullary, and has four *cornua*. The two anterior *cornua* come from the *medulla* of the brain, and are joined through the anterior commiſſure of the brain, running from one lobe to the other: the *fornix* ends poſteriorly in a broad, thin *faſcia*, which again divides into two other *cornua*, called from their figure *Pedes Hippocampi*.

The *Pedes Hippocampi*, which diverge poſteriorly, are united by means of a medullary body, marked with tranſverſe *ſtriae* like the branches of a palm tree, and called *Pſalterium*.

From the *corpus calloſum* a thin medullary partition deſcends perpendicularly into the middle of the *fornix*, dividing the cavity under the *corpus calloſum* into two equal parts. This is called *Septum pellucidum*.

The *Anterior Ventricles of the brain* are covered ſuperiorly by the *corpus calloſum*; and they are divided equally into two by the *ſeptum pellucidum.* Their anterior *crura* are turned againſt each other: they run from before backwards horizontally, by the ſides of the *corpus calloſum*; and they recede more and more from each other, as they run backwards. After this, they are turned downwards and forwards; and, in this way, they come near to each other again, and end in the middle lobe of the brain. They are lined with the *pia mater*; and, in a natural ſtate, they are moiſtened by a watery vapour, which in diſeaſe often congeals, or encreaſes ſo as to diſtend the ventricles.

In each of the ventricles mentioned, according to its length, numerous very ſmall blood-veſſels and abſorbents are extended; which are united, by means of *pia mater*, with numerous ſmall, round globules, reſembling hydatids, into a bundle, called *Plexus Choroideus.*

The *Thalami Nervorum opticorum* are two bodies placed near to each other, white in appearance, protruding at the baſe of the anterior ventricle, and running in the direction of this ventricle, inwards, a little downwards, and outwards. Their ſurface is externally convex, but internally flat.

Their external ſurface is white and medullary; and their internal ſurface is cineritious, and cortical. The *thalami nervorum opticorum* form in part the optic nerves, and in part the *crura* of the brain (506).

The *Corpora ſtriata* are two long cineritious eminences at the baſe of the anterior ventricle. They lie rather forwards, and are called *ſtriata*, becauſe their external ſurface is marked with numerous longitudinal round *ſtriae*.

They are compoſed of a cortical ſubſtance externally, and of a medullary ſubſtance internally. They concur to form the *crura* of the brain.

The *Third Ventricle* is like a long fiſſure, ſituated under the anterior ventricles, where the flat ſurfaces of the *thalami nervorum opticorum* unite. It leads forwards towards the baſe of the *cranium* through a kind of hollow, ſmall, cineritious column, called *Infundibulum*, into the pituitary gland, which is round, lying in an excavation on the *ſella turcica.* The uſe of this gland is not yet known. The third ventricle terminates poſteriorly by means of an orifice in a canal, called *Aquaeductus Sylvii*, going into the fourth ventricle, which is proper to the *cerebellum*.

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(506) It has been aſſerted that the tenuity of the cerebral nerves, compared with the ſubſtance of the brain, is greater in the human race, than in any other animal, and alſo that the larger theſe nerves are in animals, the ſmaller is their brain, in a relative proportion (Sommerring, *Diſſ. de Baſi Encephali*, &c.). J. G. Ebel has confirmed this obſervation of Sommerring, and made many ingenious remarks on the mental powers as connected with the magnitude and proportion of the nerves, which are the organs of ſenſe (*Obſ. Neurologicae ex Anat. comp.*).

The *Tubercula*, or *Eminentiae quadrigeminae* are ſmall, white oval tubercles, two of which are ſituated on each ſide over the poſterior orifice of the third ventricle, and the *Aquaeductus Sylvii*. The antients gave them particular names of no good ſignification.

Over the tubercles now mentioned there is the ſmall, conoidal, cineritious eminence, called the *Pineal Gland*, &c.

There yet remain to be conſidered the *Crura* of the Brain, which are placed inferiorly, are very white, and ariſe at the baſe of the ſkull, from the medullary ſubſtance of the brain. They are joined poſteriorly and inferiorly with the *crura* of the *cerebellum*, and from this union ariſes the *medulla oblongata*, or the Origin of the Spinal Marrow (507).

The Cerebellum.

The *Cerebellum* is much leſs than the brain, and it is ſeparated from it by a horizontal

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(507) The brain is perpetually agitated in conſequence of reſpiration; in expiration the brain is raiſed, but in inſpiration it ſubſides again (J. D. Walſtorf, *Exp. circa Motum Cerebri, Cerebelli*, &c. *Goett*. 1753.). Conſult the Phil. Tranſ. No. 287. page 1480.

ſeptum coming from the *dura mater*, called *Septum Cerebelli.*

The *cerebellum* is ſituated under the brain, poſteriorly and inferiorly, in the two excavations on the inſide of the *os occipitis*. It is divided, by a deep inciſion, into two equal hemiſpheres, which are joined to each other ſuperiorly and inferiorly by an intermediate ſubſtance, of a fabric like that of the *cerebellum*, reſembling a ring, called *Protuberantia vermiformis.*

The *Fabric of the Cerebellum*, as well as of the brain, conſiſts of a double ſubſtance; the external cineritious, ſoft, and marked with numerous convolutions ſuperficial and longitudinal, forming circular parallel arches; the internal is medullary, ariſing from the whole circumference of the *cerebellum*, and being united in its centre with the *crura cerebelli*, as they are called, which are united with the *crura cerebri*, forming by this union the *medulla oblongata.*

The *crura cerebelli* have a double termination, or, if one conſiders the ſmall part of medullary ſubſtance confuſed with the ſpinal marrow inferiorly, they have a threefold termination.

The two *interior crura* aſcend towards the *eminentiae quadrigeminae.* They are there joined with the *crura cerebri*, and conſtitute one trunk, which, immediately below the *pons*, is called *Medulla oblongata.*

The *Medulla oblongata* lies in the hollow ſurface of the proceſs of the *os occipitis* that is joined to the *os ſphoenoides.*

The two *exterior crura*, which are the larger, go from each other, and are turned ſomewhat forwards and downwards, ſurrounding the *crura* of the brain like two arches, and under theſe, they are again united to form the annular eminence, called *Pons Varolii.*

Under theſe *crura* ariſes that part of the *medulla*, which runs downwards from the *cerebellum*, and is implanted in the ſpinal marrow.

Immediately before the *pons*, the interior *crura* of the *cerebellum* form four eminences; the anterior external, called *Corpora olivaria*, the inferior *pyramidalia*, from their figure.

Between theſe four *crura*, that is, between the *medulla oblongata* and the *protuberantia vermiformis*, there is a ſmall oval cavity, which has already been called the *Fourth Ventricle.* In this, as in the other three cavities, a venous *plexus* lies, and at its bottom a kind of canal is ſeen, called *Calamus ſcriptorius.* It is covered ſuperiorly by a medullary veil, which was called by VIEUSSENIUS *Valvula magna Cerebri.* It opens anteriorly through the *Aquaeductus Sylvii* into the third ventricle, and terminates inferiorly in the ſpinal marrow (505).

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(505) The connection between the ventricles of the brain, is particularly deſcribed by Dr. Monro, to whom I refer my reader (Obſ. on the Structure and Functions of the Nervous Syſtem. Edinb. 1783.).

The Spinal Marrow.

The *Medulla ſpinalis* is a production of the *medulla oblongata* of the brain, ſituated in the cavity formed by the cervical, dorſal, and lumbar *vertebrae*, and the *os ſacrum*, and terminated inferiorly, commonly at the ſecond lumbar *vertebra* in a large nervous bundle, called from its reſemblance *Cauda equina.*

In *Figure* it is like a column, compreſſed a little anteriorly and poſteriorly, and there marked with two furrows throughout its length.

In the neck it is leſs; in the back it is narrow, but moſt inferiorly it is thick.

The *Fabric of the Spinal Marrow*, as of the brain, is compoſed of white medullary ſubſtance, and cineritious cortical ſubſtance; but with this difference, that the medullary ſubſtance is ſofter in the ſpinal marrow, is ſituated externally, and formed of numerous fibres eaſily diſtinguiſhable by the naked eye. The cineritious ſubſtance alſo, contrary to what is in the brain, is ſituated within the medullary. Like the brain, the ſpinal marrow is covered with *dura mater*, *pia mater*, and *arachnoidea tunica*, the firſt and laſt inveſting it but looſely.

Moreover, the external ſurface of the *dura mater* from the firſt cervical to the twelfth dorſal *vertebra* is covered by the *ligamentum ſerratum*

ſerratum in the interſtices of the origin of the nerves.

The *Arteries* of the brain, *cerebellum* and *medulla ſpinalis* ariſe from the internal carotid, and vertebral arteries.

The *Veins* open into all the *ſinuſes* of the head, and into the vertebral *ſinuſes.*

The *Uſe* of the Brain conſiſts in its being the organ of the ſenſes, both internal and external, and in its ſending off nerves which are the organs of ſenſe and motion.

AN
ALPHABETICAL INDEX
TO BOTH
VOLUMES.

N. B. The Roman Figures denote the Volumes, and the other the Pages. When no Volume is expreſſed, the firſt, or the laſt mentioned muſt be underſtood.

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